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Análisis de la regulación nacional sobre planificación territorial y propuesta jurídica para la incorporación del enfoque ecosistémico en los instrumentos de ordenamiento territorial en Chile a través de la Evaluación Ambiental Estratégica

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Publicaciones

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<u>Becas</u>

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Resumen

La incorporación de la variable ambiental en los instrumentos de planificación del uso de suelo, se ha concentrado en etapas previas a la decisión pese a que una vez adoptada la decisión estratégica, resulta también necesario hacer un seguimiento de los impactos o efectos ambientales que dicho plan efectivamente provoque, así como la posibilidad de que se adopten medidas destinadas a corregirlos cuando estos generen efectos adversos o imprevistos. La forma en que se realice el seguimiento variará en cada país según el respectivo ordenamiento jurídico.

El objetivo de este trabajo es conocer estas formas de seguimiento en instrumentos de planificación del suelo urbano, comparando la regulación chilena con la francesa y portuguesa, a través de 3 preguntas de investigación centradas en determinar si existe dicha etapa, si es posible modificar el instrumento de planificación ante la generación de efectos adversos y si se contemplan medidas de compensación ante dichos efectos. Este trabajo demuestra que normativamente existe una brecha significativa con las regulaciones de Francia y Portugal, ya que los instrumentos de planificación chilenos no tienen la posibilidad de adecuación, ni tampoco existe en Chile normas destinadas a compensar los efectos ambientales adversos.El seguimiento de los impactos sobre el desarrollo sustentable generado por las ciudades, ha llevado a diferentes países incorporar el instrumento de gestión ambiental de Evaluación Ambiental Estratégica (EAE). Para ello, el uso de indicadores es esencial dado que permiten monitorear y prevenir efectos adversos que se produzcan como consecuencia de la urbanización. Tras una década de funcionamiento de ese instrumento en Chile, no se había realizado una revisión de los indicadores utilizados en el marco de la EAE para monitorear los efectos generados por planes urbanos. Como no existe una estandarización de indicadores en la normativa chilena, se siguieron clasificaciones internacionales de indicadores: Clasificación de Presión-Respuesta-Estado elaborado por la OECD y Norma ISO Nº37120. Bajo estos criterios se clasificaron los indicadores de seguimiento ambiental utilizados por las regiones con mayor población en Chile. Los resultados muestran bajos porcentajes en el uso de indicadores que pueden ser categorizados de seguimiento ambiental, centrándose en aspectos urbanos. El trabajo concluye con preguntas que debiesen ser consideradas para futuras mejoras en el seguimiento de los impactos generados por la urbanización.

Abstract

The incorporation of the environmental variable into land use planning instruments has been concentrated in phases prior to decision-making, despite the fact that after the strategic decision has been made, it is also necessary to follow-up on the environmental impacts or effects produced by the plan, as well as the possibility of adopting measures to correct them when they cause adverse or unforeseen effects. The form taken by this follow-up will vary from country to country, based on the respective legal system. The objective of this study is to understand these forms of follow-up in urban land planning instruments, comparing Chilean regulations with those in France and Portugal, through 3 research questions focused on determining whether this phase exists, whether it is possible to modify the planning instrument in the event of adverse effects and

whether there are offset measures for those effects. This study shows that there is a significant gap compared to the regulations in France and Portugal, as the Chilean planning instruments cannot be adapted, nor are there any regulations in Chile aimed at offsetting adverse environmental effects.

The monitoring of the impact of cities on sustainable development initiatives has led several nations to adopt the use of the Strategic Environmental Assessment (SEA) instrument to enhance environmental management efforts. The use of indicators within this process is essential since they enable authorities to monitor and mitigate any adverse effects that may arise as a consequence of urbanization. Over a decade after the implementation of this instrument in Chile, a review of the indicators used in the SEA framework to monitor the impacts of urban planning has yet to be executed. Since there is no standardization of indicators under Chilean regulations, this study applied international classifications including the Pressure-State-Response indicator framework devised by the Organisation for Economic Co-operation and Development (OECD) in addition to the International Organization for Standardization (ISO) Standard 37120. Under these criteria, the environmental-monitoring indicators utilized in the most populous regions in Chile were classified. Results show a limited use of indicators that can be categorized as related to urban-focused environ- mental monitoring. This work concludes by posing certain questions that should be considered for future improvements to monitoring impacts generated by urbanization.

Capítulo I: Introducción General

1. El cambio de uso de suelo como cambio global

Existen diversos cambios que la biota del planeta está experimentando a escala global (Elias, 2018), los cuales tienen la capacidad de alterar la funcionalidad que le da sustento a la misma biota (Tlili & Mouneyrac, 2021). Uno de estos cambios es aquél ejercido en los usos de suelo, ya sea cambiando los usos existentes o bien intensificando algún uso ya establecido (Turner & Meyer, 1994). Estos usos han sido identificados por el Panel Intergubernamental del Cambio Climático (IPCC por su sigla en inglés) dentro de los cuales se encuentra: infraestructura (asentamientos, minería), tierras de cultivo (cropland), terrenos de pastoreo (grazing) y usos forestales y suelos en desuso (humedales, bosques nativos, entre otros) (Arneth et al., 2019).

La magnitud de estos cambios se ha intensificado en las últimas décadas llegando a niveles donde tres cuartas partes de las tierras libres de hielo en el mundo, y la mayor parte de la superficie terrestre altamente productiva, están ya bajo alguna forma de uso (Olsson et al., 2020). Winkler et al. (2021) demostró que la extensión total del cambio de la tierra es de 43 millones de km², lo que representa casi un tercio de la superficie terrestre mundial, y en promedio, una superficie terrestre de aproximadamente el doble del tamaño de Alemania (720.000 km²) ha cambiado cada año desde 1960.
Por otra parte, las actividades humanas tienden a emplazarse en zonas ricas de biodiversidad. Myers y Cincotta et al. (2000) mencionan que se han identificado

25 *hotspot* de biodiversidad repartidos en diversas partes del planeta (la Conservation International actualmente enlista 36 hotspots de biodiversidad) y estimaron que en 1995 más de 1.100 millones de personas, casi el 20% de la población mundial, vivían en estas zonas, un área que cubre aproximadamente el 12% de la superficie terrestre de la Tierra, considerando que es probable que continúen los cambios ambientales sustanciales inducidos por la humanidad, donde el cambio demográfico sigue siendo un factor importante en la conservación de la biodiversidad mundial.

Los efectos provocados por el cambio de uso de suelo pueden ser clasificados desde un punto de vista ecológico y social. En el primer grupo encontramos efectos tales como alteraciones en las comunidades de árboles y animales, introducción de especies exóticas, afectación al ciclo de nutrientes (Ojima, 1994), aumento de las concentraciones de CO2 en la atmósfera, escasez en la disponibilidad de agua (Dolman, 2003). Desde el punto de vista social, se afecta la salud al contar con ciudades más contaminadas, provocando efectos tales como mortalidad y la morbilidad por causas específicas en adultos y ancianos, así como impactos en los primeros años de vida y durante el embarazo, según plantea Gouveia et al. (2018); afectando la calidad de vida de la población generando ciudades menos caminables (OECD, 2017b); y también se afecta el crecimiento económico, pues se estima que la pérdida mundial de servicios de los ecosistemas debido al cambio de uso de la tierra equivale a 4,3-20,2 billones de dólares al año (Constanza et al., 2014).

En Chile hay evidencia que el cambio de uso del suelo de bosque nativo a plantaciones exóticas en cuencas pequeñas (<100 ha) reduce la escorrentía superficial, principalmente debido al aumento de la evapotranspiración (Huber et al., 2008), o que las funciones hidrológicas son más eficientes en las cuencas con cubierta forestal, compuesta por especies nativas o exóticas, que el uso de tierras agrícolas con rotaciones de cultivos anuales (Esse et al., 2021); otros estudios han mostrado que los cambios históricos en el paisaje (ocurridos durante los asentamientos indígenas, la conquista española y la República de Chile hasta mediados del siglo XX), no alteraron significativamente los flujos de sedimentos y nutrientes hacia el lago Vichuquén, en tanto que sí se experimentaron los mayores cambios en el sistema de la cuenca de este lago, particularmente después de las décadas de 1980 y 1990, caracterizándose por un gran aumento en los flujos totales de nitrógeno y carbono orgánico que coincidió con la mayor transformación de la cobertura terrestre en la cuenca, ya que los bosques nativos casi desaparecieron mientras que las plantaciones de árboles exóticos se expandieron hasta el 60% de la superficie (Fuentealba et al., 2021). Otros estudios como Schulz et al. (2010) muestran que durante los años 1975 al 2008 la agricultura, las áreas urbanas y las plantaciones madereras aumentaron a tasas anuales de 1,1%, 2,7% y 3,2%, respectivamente y que la mayoría de las áreas que fueron revegetadas pasivamente permanecieron como matorrales y no se convirtieron en bosques debido a la baja capacidad de recuperación forestal. En cuanto a suelos urbanos, se ha medido las variaciones en ciudades intermedias como Temuco en que, entre 1985 y 2017, se produjo un aumento en la cobertura urbana, que llegó a crecer casi el doble de lo que representaba en 1985 (96% de crecimiento), aumentando 2.130 nuevas hectáreas, lo que denota lo espectacular del fenómeno (Maturana et al., 2021);

otro ejemplo de estas ciudades lo encontramos en Chillán donde entre 1943 y el año 2000 triplicó su tamaño, pasando de 830 hectáreas a 2.443,3 hectáreas (Azócar et al., 2003).

2. La urbanización como cambio de uso suelo y sus efectos ambientales.

La urbanización es una de las causas del fenómeno global del cambio de uso de suelo. Las ciudades y las áreas metropolitanas son motores de crecimiento económico y contribuyen con alrededor del 60 % del PIB mundial. Sin embargo, también representan alrededor del 70 % de las emisiones globales de carbono y más del 60 % del uso de recursos (United Nations Statistics Division, s. f.).

Los procesos de urbanización y el modo de vida asociado a las urbes están intrínsecamente ligados al cambio global, dado que sus formas de desarrollo se han convertido en *hotspots* tanto en la demanda de recursos como en sus impactos ambientales (Steffen et al. 2005). Por ejemplo, el consumo medio de recursos per cápita en todo el mundo es actualmente de unas 8 toneladas al año, unos 22 kilogramos (kg) por persona al día, aumentando a unos 40 kg de recursos al día si se incluye lo que se extrae pero no se utiliza (UNEP, 2013), lo que trae aparejado que si bien el uso del suelo urbano, en forma de áreas construidas o pavimentadas, ocupa menos del 2% de la superficie de la Tierra, pero los servicios proporcionados por los ecosistemas que cubren áreas mucho más grandes son necesarios para mantener a las poblaciones urbanas (Steffen et al., 2005). En efecto, la mayoría de las nuevas superficies artificiales se construyen en tierras de cultivo, con la excepción de un puñado de países en los que el desarrollo tiene lugar principalmente en zonas arboladas, praderas o matorrales (OECD, 2018).

Durante el siglo XX, la urbanización y grandes centros urbanos se mantenían en un número bajo para considerar que estos podían afectar ecosistemas. En 1900, apenas había 43 ciudades en el mundo que superaban los 500.000 habitantes, y sólo 16 superaban a 1.000.000 de personas. Pero desde 1950, el número de grandes ciudades ha aumentado muy rápidamente (Berry, 2008) llegando a superar las 500 ciudades con población sobre el millón de habitantes (UN, 2018). Latinoamérica se ha transformado en una de las áreas con más altas tasas de urbanización a niveles similares de los que se registran en Norte América (UN, 2018). Angel et al. (2005) señala que las ciudades de países en desarrollo con más de 100.000 habitantes contenían 1.700 millones de personas en el año 2000, y su superficie total construida era del orden de 200.000 km^2, en tanto que para ciudades de países desarrollados, contenían 600 millones de personas para el mismo año y su área construida fue de 200.000 km2. Este mismo estudio señala que al 2030 en ciudades de países en desarrollo cada nuevo residente convertirá, por término medio, unos 160 metros cuadrados a suelo urbano, mientras que en las ciudades de países desarrollados cada nuevo residente convertirá 500 metros cuadrados (Angel et al. 2005).

Dentro de los efectos ambientales del uso urbano existe evidencia asociada a la contaminación del aire, que causa un amplio rango de efectos sobre la salud de

las personas como irritación de ojos hasta la muerte (Cohen et al., 2004); alteraciones a procesos hidrológicos, a través de la expansión de zonas impermeables que ha provocado aumento de las tasas de escorrentía y pérdidas de infiltración (Fletcher et al., 2013), que altera la interacción aguas subterráneas-superficiales (Price, 2011), modificaciones en la composición química y física de fuentes de aguas en áreas urbanas que son sustancialmente distintas que en áreas rurales (Niemczynowicz, 1999), degradando la calidad del agua y aumentando las cargas de nutrientes y microbianas (Hassan Rashid et al., 2018). La biodiversidad también es afectada por la urbanización, a través de la pérdida de especies nativas, invasión de especies exóticas, erosión pronunciada de los suelos (Hansen et al., 2004), la fragmentación de hábitats y paisajes y su conectividad (Mcdonald et al., 2008), La influencia sobre ciertas ecorregiones que contienen más de un tercio de su área urbanizada, arriesgan cerca de un 12% de las especies de vertebrados terrestres del mundo y aumentar la probabilidad que un vertebrado sea catalogado como amenazado. , junto con la consiguiente afectación a los distintos servicios ecosistémicos que nacen de procesos ecológicos (Wade, 2019). Bartone et al. (1994) indican que las distorsiones en los mercados de tierras urbanas y las políticas y prácticas ineficaces de ordenación de las tierras en los países en desarrollo han dado lugar además a otros fenómenos, como la ocupación de zonas propensas a peligros (por ejemplo, laderas empinadas, llanuras aluviales y tierras baldías adyacentes a industrias contaminantes o lugares de eliminación de desechos); y la pérdida de recursos culturales, espacios abiertos y tierras agrícolas de primera calidad. Entre 2000 y 2005, se comprobó una correlación positiva entre la deforestación con el crecimiento de la población urbana (DeFries et al., 2010; Gaveau et al., 2009).

En Chile, la concentración de la población urbana se centra en algunas regiones administrativas. Desde una perspectiva ambiental, se puede mencionar que Chile contiene una zona bioclimática mediterránea reconocida como uno de los *hotspots* de biodiversidad del mundo (abarca parte de la región de Valparaíso, Metropolitana y O´Higgins), región que presentó un alza de su población de un 53% durante los años 1970 a 2002 (Schulz et al. 2010). Figueroa et al. (2013) precisa que este clima mediterráneo ocurre solamente en la zona central del país, específicamente entre las regiones de Coquimbo y Bío-Bío. El Consejo Nacional de Desarrollo Urbano de Chile informaba al año 2012 que sobre el 70% de la población chilena vive y desarrolla sus actividades en centros de más de cinco mil habitantes, lo que en otras palabras está significando que Chile es un país con características urbanas dominantes (Giménez & Gazitua, 2012).

3. La regulación del urbanismo

El hecho urbanístico como fenómeno regulatorio tiene su data de origen desde hace varios siglos como destaca Gómez (2003). Sin embargo, los objetivos regulatorios eran distintos, enfocados a pautas o actos de carácter administrativos (infra-legales) destinados a regular el derecho de propiedad de quienes buscaban dar un uso a un predio en particular (Gómez 2003), Arbouin-Gómez 2012), Ríos 2015).

En otras palabras, la regulación urbanística existía en tanto era necesaria para

limitar la propiedad en un aspecto particular: el derecho a edificar en el predio.

El posterior desarrollo normativo del urbanismo, se plasmó en el rol de los Estados a promulgar cuerpos normativos de jerarquía legal con distintos objetivos y junto con ello, utilizar otros instrumentos orientadores o estratégicos de la acción del Estado en la sociedad como son las políticas nacionales. Una Política Nacional Urbana se define entonces, como un conjunto coherente de decisiones derivadas de un proceso deliberado dirigido por el gobierno para coordinar y reunir a diversos actores en torno a una visión y un objetivo comunes que promuevan un desarrollo urbano más transformador, productivo, inclusivo y resistente a largo plazo (UN-Habitat, 2014b). Al respecto, de los 193 Estados miembros de la ONU se han identificado 150 Políticas Nacionales Urbanas (UN-Habitat & OECD, 2018).

Las áreas de mayor interés que se encuentran desarrolladas en estas políticas nacionales son el crecimiento económico y estructura espacial (42% y 44%, respectivamente, de un total de 108 Políticas Nacionales analizadas); en desmedro de las áreas de resiliencia climática y sustentabilidad ambiental (con un 10% y 26%, respectivamente) que representan un bajo nivel de consideración en este tipo de políticas (UN-Habitat & OECD, 2018).

Si bien estas políticas no son vinculantes para el Estado ni para particulares, sí determinan la voluntad de los respectivos países para avanzar en ciertas áreas de interés. De esta manera, lo que se plasme o no se plasme en ellas, se reflejará en la formulación de otros instrumentos que, reuniendo características de obligatoriedad, incorporen las áreas que sean de interés a nivel de política. Mousmouti (2020) destaca que “las políticas urbanas requieren de la legislación para adquirir carne y hueso, y los marcos legislativos urbanos establecen las características específicas de gestión y desarrollo del modelo de desarrollo urbano”. Esta misma autora destaca que a pesar del rol relevante de la legislación urbana, parece ser un elemento olvidado, debido a diversas circunstancias como: escasa renovación de la normativa urbanística, que impide se actualice ante los nuevos desafíos (como acceso a la vivienda, función social del suelo, etc); falta de claridad en la normativa que han tenido repercusiones negativas en la competitividad y el crecimiento económico y han dado lugar a acuerdos informales y a la corrupción; la normativa urbanística no tiene un método claro y se encuentra desconectada de los contextos locales.

Este diagnóstico es crítico, atendido que el urbanismo se ha transformado en una pieza clave para el logro de las metas de desarrollo sustentable que los países se han fijado. Por ejemplo, en 1976 el Informe de Hábitat: Conferencia de las Naciones Unidas sobre los asentamientos humanos (conocida como la Declaración de Vancouver) describió a la urbanización como un problema que conduce al hacinamiento, la contaminación y el deterioro general de las condiciones de vida en las zonas urbanas; y señalaba que “una política integrada en materia de asentamientos humanos debería estar en armonía con la conservación, la restauración y el mejoramiento del medio ambiente natural y artificial, consciente de la función positiva del medio ambiente en el desarrollo económico y social nacional” (Naciones Unidas, 1976).

En el mismo sentido, los Objetivos de Desarrollo Sustentable (ODS) acordados el año 2015, dan cuenta de la relevancia que tiene el urbanismo, pues el objetivo Nº11 titulado “Ciudades y comunidades sostenibles” comprende diversas metas que guardan directa relación con los efectos ambientales del urbanismo, como es el caso de la meta 11.4 de “redoblar los esfuerzos para proteger y salvaguardar el patrimonio cultural y natural del mundo”; meta 11.6 para que “de aquí a 2030, reducir el impacto ambiental negativo per cápita de las ciudades, incluso prestando especial atención a la calidad del aire y la gestión de los desechos municipales y de otro tipo”; meta 11.b de “aquí a 2020, aumentar considerablemente el número de ciudades y asentamientos humanos que adoptan e implementan políticas y planes integrados para promover la inclusión, el uso eficiente de los recursos y la mitigación del cambio climático”.

Asimismo, existen otros ODS vinculados a los impactos del urbanismo, como es el caso del objetivo Nº3 que garantiza una vida sana y promueve el bienestar para todos, y de todas las edades, donde una de las metas para el año 2030, reducir sustancialmente el número de muertes y enfermedades producidas por la contaminación del aire, el agua y el suelo; el objetivo Nº6 para asegurar el acceso de todos al agua y sanitización, donde se contempla como meta para 2020, proteger y restaurar los ecosistemas relacionados con el agua, incluidas las montañas, los bosques, los humedales, los ríos, los acuíferos y los lagos y; el objetivo Nº8 que busca promover el crecimiento económico inclusivo y sustentable, empleo y trabajo decente para todos, que comprende como una de sus metas mejorar progresivamente, hasta 2030, la eficiencia mundial de los recursos en el consumo y la producción y esforzarse por desvincular el crecimiento económico de la degradación ambiental.

Otro ejemplo internacional encontramos en la Tercera Conferencia de las Naciones Unidas sobre Vivienda y Desarrollo Urbano Sostenible (Hábitat III, 2016), donde se definió abogar por políticas proactivas para aprovechar la dinámica de la urbanización como instrumentos de desarrollo sostenible, comprometiéndose a aplicar a largo plazo procesos de planificación urbana y territorial y prácticas de desarrollo espacial, con gestión y planificación integrada a los recursos hídricos, teniendo en cuenta la continuidad entre las zonas urbanas y las rurales a escala local y territorial. Al mismo tiempo, reconoce la función rectora de los Gobiernos nacionales, según proceda, en la definición y aplicación de políticas urbanas inclusivas y eficaces, y leyes para el desarrollo urbano sostenible, así como las contribuciones igualmente importantes de los gobiernos subnacionales y locales, de la sociedad civil y otros interesados pertinentes, de manera transparente y responsable (Conferencia de las Naciones Unidas sobre Vivienda y Desarrollo Urbano Sostenible, 2017).

Por otra parte, la fragmentación de la gestión ambiental ha contribuido a institucionalizar contradicciones entre los objetivos y fines de la gestión de un recurso en particular (como el suelo) con los objetivos y fines de otro (como el agua). Esta fragmentación regulatoria en la gestión ambiental ha intentado ser enfrentada por los Estados siguiendo distintos tipos de alternativas como la planificación, o bien en forma sectorial, o bien en relación con la investigación de los recursos naturales (Gligo, 1997). En 1972 la Declaración de Estocolmo señaló que los Estados deberían adoptar un enfoque integrado y coordinado en

la planificación de su desarrollo, de modo que quede asegurada la compatibilidad del desarrollo con la necesidad de proteger y mejorar el medio humano en beneficio de su población. En 1992, la Declaración de Río sobre Medio Ambiente y el Desarrollo, proclamaba que, a fin de alcanzar el desarrollo sostenible, la protección del medio ambiente deberá constituir parte integrante del proceso de desarrollo y no podrá considerarse en forma aislada (Principio 4). La Agenda Local 21 que derivó de esta misma Declaración, señalaba en su capítulo 8º que "En los sistemas actuales de adopción de decisiones de muchos países se tiende a seguir separando los factores económicos, sociales y del medio ambiente a nivel de políticas, planificación y gestión. Ello influye en la actuación de todos los grupos de la sociedad, incluidos los gobiernos, la industria y los particulares, y tiene consecuencias importantes para la eficiencia y la sostenibilidad del desarrollo. Tal vez sea necesario efectuar un ajuste, o una reformulación fundamental del proceso de adopción de decisiones, a la luz de las condiciones concretas de cada país, para que el medio ambiente y el desarrollo se sitúen en el centro del proceso de adopción de decisiones económicas y políticas, de manera que se logre de hecho la plena integración de esos factores".

Esta fragmentación también se refleja en el enfoque dado a la normativa urbanística, por ejemplo, al entregar la regulación aplicable a la prestación de servicios públicos, la del suelo rural, la de los objetivos socio-económicos perseguidos al momento de planificar, a distintos organismos con fines legales particulares y que cuentan con escasas instancias de coordinación entre ellos. Esta situación encuentra terreno fértil ante los problemas ambientales provocados por el urbanismo pues estos aparecen en varias escalas espaciales, por lo que requiere ser tratados en sus diversos niveles: local o municipal; metropolitanos o supra-municipales; regionales y nacionales; para que las variables ecológicas sean abordadas y no las meramente institucionales (UN-Habitat, 2016). En atención a lo anterior, la ONU en un documento titulado "La implementación de los principios de urbanización planeada: Un enfoque ONU-HABITAT para el desarrollo urbano sustentable" considera el enfoque integrado, indicando que este busca combinar diversos lentes y alinearlos para que múltiples y diversos actores pueden avanzar desde un punto común, para lo cual considera tres componentes: regulación, diseño urbano y plan financiero (UN-Habitat, 2016b).

4. La Evaluación Ambiental Estratégica de instrumentos urbanísticos

Las planificaciones del Estado respecto de los usos de suelo urbanos, se materializan a través de instrumentos tales como políticas y planes (Ornés, 2009; OECD, 2017; Rajevic, 2000). De acuerdo a Wood y Djeddour (1992), los términos "políticas", "planes", "programas" y "proyectos" pueden variar en cada país, pero en general una planificación del Estado comienza en un primer nivel con una política (donde está la inspiración y orientación de una acción deseada); para luego pasar a un segundo nivel con un plan (donde se establecen objetivos coordinados para aplicar la política) y finalmente el nivel del programa (que comprende una serie de proyectos en un área determinada). Esta lógica escalonada puede aplicarse desde un nivel nacional, regional o local, así como puede aplicarse a actividades sectoriales (Wood & Dejeddour, 1992). Se

diferencia de un proyecto, en tanto este comprende una actividad concreta en términos de su localización y diseño técnico (Partidário, 1994).

El contenido normativo de estos instrumentos ha ido incorporando paulatinamente (Cutaia, 2018) objetivos de protección ambiental, reconociendo las interacciones entre los distintos usos de suelo y sus efectos sobre el ambiente mediante procesos de evaluación ambiental.

Desde la década del 60-70, se ha empleado la evaluación de impacto ambiental EIA, cuyo objetivo es la incorporación de la variable ambiental a la toma de decisiones de ciertas políticas, planes, programas y especialmente actividades o proyectos de inversión (Nilsson & Dalkmann, 2001; Partidario, 1996; Van der Vorst et al., 1999; Wood & Dejeddour, 1992), permitiendo aumentar el nivel de atención hacia consideraciones ambientales en este tipo de iniciativas.

Sin embargo, la EIA pone énfasis en proyectos de desarrollo (como una carretera o un proyecto energético) por lo que presenta diversas deficiencias (Feldmann, 1998; Gómez, 2014, p. 41; Therivel, 1993) en la evaluación de aquellos instrumentos más generales y abstractos que contienen la planificación del Estado en ciertas áreas (como una política energética o planificación territorial), lo que abrió paso a la Evaluación Ambiental Estratégica (EAE) como una herramienta que mejora las EIA (Partidário, 1996). Esto ha sido principalmente cierto en instrumentos de planificación del uso de suelo, como se puede ver en la experiencia europea, donde en su IV Taller Europeo sobre Evaluación de Impacto Ambiental de la Comisión Europea de Medio Ambiente, destacó que las mayores experiencias de EAE en sus estados miembros, se daba precisamente en las planificaciones de uso de suelo (Kleinschmidt & Wagner, 1998).

Dentro de las deficiencias marcadas por la literatura, se menciona que este énfasis en el nivel de proyectos impide realizar evaluaciones adecuadas a los instrumentos que deberían precederle (Gómez, 2014). En efecto, la EIA para "el caso de desarrollo de carreteras no se toman en consideración temas tales como los modos de transporte menos contaminantes o las mejoras en los transportes públicos, trenes y bicicletas, y solo se consideran las rutas alternativas a la ruta proyectada. Las medidas mitigadoras se limitan y concentran principalmente en los impactos generales asociados a un esquema de transporte en concreto, por ejemplo, barreras contra el ruido o paisajismo" (Haq, 2006). La EIA se concentra en proyectos particulares que se desarrollan bajo el supuesto de existir previamente decisiones estratégicas adoptadas por las autoridades respectivas. Sin embargo, la integración de las variables ambientales en tales decisiones estratégicas presenta características distintas a la decisión de permitir o no un proyecto en particular (Partidário, 2000).

Otra deficiencia identificada de la EIA para decisiones estratégicas, tienen que ver con su omisión en predecir y evaluar impactos indirectos, colaterales, acumulativos y sinérgicos de proyectos más o menos relacionados (Gómez, 2014). Una decisión estratégica como una política energética del país tendrá impactos sobre un territorio y durante un periodo mucho más amplio que los generados por un proyecto hidroeléctrico emplazado en una zona puntual. Esto

permite que la EAE llegue antes a producir la consideración de las variables ambientales en los instrumentos más estratégicos (Partidário, 1996).

Además, la EAE evita la exclusión de alternativas y oportunidades que se presentan durante la evaluación de un proyecto (Haq, 2006). Clark (1997) destaca que la EIA "no es suficiente como mecanismo de gestión ambiental, pues a menudo no se consideran alternativas, ya sea de lugar o de proceso, no se aborda el carácter dinámico de las interacciones entre medio ambiente y desarrollo, y se descuidan los impactos acumulativos" y cuando estas alternativas son requeridas en EIA, se da para ubicaciones específicas, diseño, construcción u operación del proyecto en particular, en tanto la EAE no solo debe hacer consideraciones amplias en términos espaciales y temporales sino también vincularlo con decisiones sociales y económicas (Partidário, 2004).

Por tanto, la EAE es considerada como la vía idónea para identificar, en un proceso formalizado de evaluación y en una etapa temprana, los impactos ambientales de decisiones adoptadas en un nivel de políticas, planes y programas (Partidário, 1996) y como una herramienta que permite vincular la degradación de la naturaleza con los ODS de reducción de la pobreza (OCDE, 2010), además que se reconoce su influencia sobre la elección de alternativas de desarrollo durante las primeras etapas de la toma de decisiones. En otras palabras, la EAE puede facilitar un enfoque proactivo para asegurar que las consideraciones ambientales y de sustentabilidad sean tomadas en cuenta durante las etapas iniciales de un proceso de toma de decisión estratégica (Fundingsland & Hanusch, 2012).

Chile incorpora la EAE el año 2010, estableciendo dentro de su proceso de evaluación que todos los instrumentos de planificación territorial deben someterse a este (Cordero & Vargas, 2016). El objetivo fue incorporar las consideraciones ambientales del desarrollo sustentable, al proceso de formulación e implementación de las políticas y planes de carácter normativo general, que tengan impactos sobre el medio ambiente o la sustentabilidad, de manera que ellas sean integradas en la dictación de la respectiva política y plan, y sus modificaciones sustanciales; y anticipar eventuales efectos ambientales adversos asociados o que puedan derivarse de la definición de una determinada política o plan y de ese modo, considerar la prevención o mitigación de tales efectos o los mecanismos para evitar la generación de efectos ambientales acumulativos (Biblioteca del Congreso Nacional de Chile, 2018). Previamente, los instrumentos de planificación existentes eran evaluados en el sistema de EIA, aunque durante este periodo los informes oficiales sostenían que los instrumentos para la planificación del territorio no lograron evitar la presión ambiental causada por el cambio en el uso de los suelos; problemas como la expansión urbana descontrolada y la ubicación de fábricas en zonas ambientalmente sensibles (hoy transformadas en zonas de sacrificio) o en áreas vulnerables a desastres naturales por lo que se propuso la incorporación del instrumento de la EAE (OECD, 2005).

Actualmente en Chile, los instrumentos de planificación territorial que establecen la regulación aplicable a los usos de suelo se restringen casi exclusivamente al ámbito urbano, y su objetivo legal es orientar y regular el desarrollo de los centros

urbanos en función de una política nacional, regional y comunal de desarrollo socio-económico (Art. 27 Ley General de Urbanismo y Construcciones). La planificación urbana se efectúa en tres áreas: nacional, intercomunal y comunal, siendo estos dos últimos niveles existentes obligatorios. De acuerdo a la legislación chilena, la planificación urbana comunal promueve el desarrollo armónico del territorio comunal, en especial de sus centros poblados, en concordancia con las metas regionales de desarrollo económico-social. Esta planificación urbana comunal se realiza por medio del Plan Regulador Comunal ((PRC).

De acuerdo a la normativa chilena, tanto los PRC como sus modificaciones sustanciales deben someterse a EAE para incorporar las consideraciones de desarrollo sustentable, es decir, objetivos y efectos ambientales, y criterios de desarrollo sustentable. Además, se estableció que el acto administrativo que da término al proceso de la EAE, debe contener la identificación de los indicadores de seguimiento destinados a controlar su eficacia, es decir, elementos de análisis destinados al conocimiento y evaluación de los resultados de la implementación de un plan urbano sometido a EAE (Decreto Supremo 32, año, MMA, Chile).

5. La consideración de las variables ambientales

Como se ha indicado anteriormente, la EAE busca considerar variables ambientales en etapas tempranas de ciertos instrumentos estratégicos. La EAE puede facilitar un enfoque proactivo para asegurar que las consideraciones ambientales y de sustentabilidad sean tomadas en cuenta durante las etapas iniciales de un proceso de toma de decisión estratégica (Fundingsland & Hanusch, 2012). Ahora bien, esta consideración no se limita exclusivamente a la integración en la etapa de formulación de una política o plan, sino que también contempla una fase de verificación.

Según Gómez (2014) esta verificación contempla dos facetas: la comprobación de que efectivamente se ha hecho un esfuerzo de integración ambiental en la elaboración de la política, plan y programa y la evaluación del resultado conseguido, que se realiza a través de la identificación, valoración, prevención y seguimiento de los impactos que se producirían en caso de que llegue a ejecutarse. Al respecto, resulta llamativo indicar que en el IV taller europeo de EIA se puntualiza que los especialistas no estuvieron totalmente de acuerdo en que los resultados de la EAE fueran vinculantes por la autoridad (Kleinschmidt & Wagner, 1998), lo que habla de la alta relevancia que se le buscaba dar al seguimiento.

6. Objetivos de investigación e hipótesis

Este proyecto de investigación formuló como Objetivo General “Comprender los efectos de la regulación de la EAE en Chile y su impacto al incorporar los Servicios Ecosistémicos (SE) en las políticas y planificaciones sectoriales con incidencia territorial”, lo que implica entender cómo la EAE ha logrado incidir en instrumentos territoriales incorporando servicios ecosistémicos.

Además, como objetivos específicos se formularon:

i) Determinar las diferencias respecto a la consideración de los SE en las políticas y planificaciones sectoriales con incidencia territorial sometidas a EAE con aquellas que no se someten.
ii) Describir las diferencias, según sea el modelo de EAE, en la incorporación de los SE en los instrumentos de ordenamiento territorial.

Como hipótesis, el proyecto de investigación propone: para que los SE se incorporen a los instrumentos de ordenamiento territorial y en las políticas y planificaciones sectoriales con incidencia territorial, es necesario que se hagan en el marco de una EAE que exija expresamente la consideración de estos servicios.

7. Formulación de la propuesta de investigación

Para dar cumplimiento a los objetivos descritos previamente es necesario tener en cuenta los siguientes aspectos: en primer lugar, la normativa nacional opta por la EAE como el instrumento para incorporar la variable ambiental a ciertos instrumentos, como los que regulan el uso de suelo, según se indicó arriba. En efecto, Chile al seguir la recomendación de la OCDE de establecer la EAE para evaluar ambientalmente los instrumentos de planificación territorial, opta por concentrar las posibilidades de integrar las variables ambientales a través de la EAE. Si se analiza la legislación vinculante en materia de usos de suelo, no se contempla la exigencia de tomar en cuenta variables ambientales, según se tendrá ocasión de detallar más adelante. Esto delimita el ámbito de acción que se requiere analizar para comprender cómo las variables ambientales están consideradas en los instrumentos que regulan el uso de suelo.

Lo expuesto deriva en un segundo aspecto a tener en cuenta: la EAE de acuerdo a la legislación nacional se contempla (en términos obligatorios) para los instrumentos que pueden regular el uso de suelo. Sin embargo, de los distintos instrumentos que se encuentran mencionados en la legislación nacional, solo algunos tienen un efecto vinculante para toda persona y autoridad pública. Precht et al. (2016) señalan que “la normativa que se establece mediante estos instrumentos es de cumplimiento obligatorio, existiendo sanciones en caso de incumplimiento. Todos los instrumentos de este tipo se encuentran establecidos en el Título II de la LGUC (se refieren a la Ley General de Urbanismo y Construcciones)”. Dentro de los instrumentos normativos que se mencionan están los Planes Reguladores Intercomunales, Planes Reguladores Comunales, Plan Seccional y Límites Urbanos. Respecto de estos instrumentos corresponde señalar que su ámbito de acción se centra exclusivamente en lo urbano (Cordero, 2007).

Dentro de tales instrumentos mencionados, resultan de especial interés para los objetivos de esta investigación los planes reguladores intercomunales y comunales, principalmente porque se trata de los instrumentos más utilizados y con mayor incidencia en definir los usos de suelo, y también porque la normativa aplicable a ellos define la competencia para fijar la zonificación en un determinado espacio geográfico.

Un tercer aspecto a tener en cuenta tiene que ver con la expresión de los SE, puesto que los objetivos están centrados en comprender cómo la EAE ha incidido en la consideración de éstos. Al respecto, de acuerdo a Delgado (2014) la legislación nacional se ha referido a ello en tres ocasiones: En la ley Nº20.283 que habla de “servicios ambientales”; en el Decreto Supremo 14/2013 del Ministerio de Medio Ambiente, que aprueba el reglamento para la determinación del caudal ecológico mínimo también utilizaba la expresión de “servicios ambientales” (aunque posteriormente se modificó y su texto actualmente vigente habla de “ecosistémicos”); y por último el reglamento del Sistema de Evaluación de Impacto Ambiental (SEIA) que se refiere a los “servicios ecosistémicos”. Por otra parte, el reglamento de la EAE no alude a esta expresión y, pero si alude en su artículo 2 que “El objetivo de la Evaluación Ambiental Estratégica es la incorporación de consideraciones ambientales del desarrollo sustentable al proceso de formulación de las políticas, planes e instrumentos de ordenamiento territorial que la ley establece”. Además, precisa que las “consideraciones ambientales de desarrollo sustentable” son el conjunto de objetivos ambientales, efectos ambientales, criterios de desarrollo sustentable que una política, plan o instrumento de ordenamiento territorial, incorpora en su proceso de elaboración o modificación sustancial, al ser sometido a EAE.

Esto da cuenta que los instrumentos de planificación del uso de suelo no tienen la obligación de hacer una consideración de los SE mientras estén sometidos a su propia EAE. De hecho, Rozas-Vásquez et al. (2018) en un estudio realizado con la EAE en Chile sobre instrumentos de planificación territorial señala que la documentación asociada a estos hace alusiones tácitas o expresas a los servicios ecosistémicos, como "servicios ambientales", "funciones ambientales" y "capital natural", que suelen utilizarse indistintamente para hacer referencia a los SE. Por ello en este trabajo se opta por no limitarse a la expresión “servicios ecosistémicos” sino que el uso de otras expresiones que son utilizadas en los instrumentos de planificación del uso de suelo y que refieren a aspectos ambientales o ecosistémicos.

Por último, una de las fases más olvidadas de la EAE tiene que ver con la etapa de seguimiento. Sobre esta etapa Cherp et al. (2011) en un trabajo internacional, indica que “es sorprendente que el debate sobre este tema haya sido bastante limitado hasta ahora. Aunque la necesidad del seguimiento de la EAE se señaló en las primeras publicaciones del proceso, desde entonces sólo ha habido un puñado de trabajos de investigación sobre este tema”. El mismo fenómeno ocurre en Chile, donde Rozas-Vásquez et al. (2018), indica que hay una baja consideración de los servicios ecosistémicos en la etapa de seguimiento, aunque a esta conclusión se llega con un análisis de 15 informes ambientales de EAE (5 de nivel regional; 5 intercomunales y 5 comunales).

Atendido lo expresado, para buscar una comprensión de cómo la EAE incide en los instrumentos con competencia para regular el uso de suelo, esta propuesta de investigación se enfocó en analizar el modelo de seguimiento de EAE de nuestro país, comparando con otros modelos de referencia internacional, para luego analizar cómo este modelo incide en los instrumentos de planificación territorial, lo que es posible mediante el uso de indicadores específicos se trata de una investigación que se enmarca dentro de una década de funcionamiento

de la EAE en Chile, en un área que la literatura especializada internacional ha observado una falta de análisis, como es la etapa de seguimiento, que tiene su réplica en el escenario nacional donde no se han realizado estudios al respecto su incidencia en los instrumentos de uso de suelo.

Lo que se busca con esta investigación, es analizar el mecanismo legal definido por la normativa chilena (EAE) para incorporar la variable ambiental a los instrumentos de planificación del territorio, para lo cual se realiza una revisión comparada y una empírica.

Capítulo II: Materiales y Métodos

De acuerdo al objetivo específico que plantea "Describir las diferencias, según sea el modelo de EAE, en la incorporación de los SE en los instrumentos de ordenamiento territorial", se buscaron referencias internacionales de modelos de EAE empleados en legislaciones internacionales, seleccionando Francia y Portugal, para realizar una revisión comparada con Chile de las normas establecidas en los instrumentos de planificación territorial vigentes en cada país y de la EAE.

En base a la revisión de la normativa vigente en cada uno de los países seleccionados, se respondieron las tres siguientes preguntas de investigación:
1. ¿El proceso de la EAE del instrumento de planificación territorial tiene contemplada la etapa de seguimiento de las variables ambientales que pudieren verse afectadas por el respectivo instrumento?
2. ¿Se incluyen disposiciones que establezcan la necesidad de modificar el instrumento de planificación territorial como consecuencia del seguimiento de las variables ambientales para evitar efectos indeseados o distintos a los originalmente considerados?
3. ¿El proceso de EAE exige a los instrumentos de planificación territorial contemplar medidas de compensación ante efectos ambientales adversos que genere el respectivo instrumento?

La selección de estos países se realizó en base a los siguientes criterios. En primer lugar, Chile suscribió un acuerdo con la Unión Europea para recoger las lecciones y aprendizajes de la experiencia que ha tenido en materia de EAE, y traspasar en su implementación en Chile. En segundo lugar, era necesario tener en cuenta que Chile al ser un país unitario, tiene desarrollado una normativa sobre la EAE de aplicación nacional (aspecto territorial) y además dicha normativa tiene un rango legal (aspecto jerarquía normativa). Por tanto, se excluyen a países federales que permiten a entidades subnacionales desarrollar normas específicas para cada una de ellas, como es el caso de países como Alemania, España e Italia. Además, los 3 países forman parte de la OCDE, por lo que se someten a evaluaciones provenientes de un mismo órgano internacional. Asimismo, en el caso de Portugal se proporciona un modelo normativo que parte desde lo nacional, regional, y local, similar a la forma que se hace en Chile junto con el diseño de políticas que integran políticas sectoriales (OCDE, 2017); Francia reúne características similares a la chilena en torno a la

planificación territorial, dado que otorga fuertes competencias a las instancias nacionales para el diseño y aplicación de políticas ambientales, energéticas, infraestructuras, entre otras, dejando a las instancias locales, la definición de lo que se puede construir a través del otorgamiento de permisos que habilitan la construcción (OCDE, 2017).

Respecto al objetivo de "Determinar las diferencias respecto a la consideración de los SE en las políticas y planificaciones sectoriales con incidencia territorial sometidas a EAE con aquellas que no se someten", el estudio realizó una recopilación de los indicadores de seguimiento definidos para el control de la eficacia de los planes utilizados en el marco de la EAE del Plan Regulador Comunal (PRC). Para conocer cuáles son los instrumentos de planificación territorial que se han sometido a EAE, el MMA lleva un registro disponible (a través de distintos formatos) en la página web oficial destinada al efecto: https://eae.mma.gob.cl/.

Se identificó el total de instrumentos que se han sometido a EAE sean políticas sectoriales, planes de zonificación sectoriales, planes reguladores intercomunales o PRC, e independiente de la etapa de tramitación de la EAE en la que se encuentren, dando un resultado de 411 instrumentos sometidos a EAE desde la entrada en vigencia de la ley hasta el 1 de marzo de 2021, de los cuales 291 corresponden a PRC representando un 71%.

Posteriormente se realizó un segundo filtro: del total de PRC se consideraron solo aquellos que han llegado a la etapa de la dictación de dos actos administrativos: resolución de término y de aprobación del instrumento. La resolución de término es dictada por el órgano responsable del PRC (es decir, y en términos generales, la municipalidad respectiva) y tiene por función finalizar la etapa de aprobación de la EAE del PRC, dando cuenta de que se han cumplido las etapas y requisitos que se exigen para este tipo de evaluación (Cordero, 2019). La resolución de aprobación del instrumento es dictada por el órgano encargado respectivo y su función consiste en que a partir de ella el PRC se entenderá como un instrumento vigente. Por tanto, la diferencia entre ambos actos administrativos se da en que la resolución de término, declara que el proceso de EAE del PRC ha finalizado; en tanto que el de aprobación del instrumento declara que el PRC está aprobado, lo que supone que cumplió con todas las etapas administrativas necesarias para que entre en vigencia, una de ellas es la tramitación de la EAE. En ambos actos administrativos se señalan los indicadores cumplidos, por tanto, cuando no aparecían en la resolución de aprobación, se revisaba la resolución de término. Estos actos administrativos se seleccionaron debido a que dan cuenta que la EAE del PRC no sufrirá futuras modificaciones respecto de los indicadores utilizados pues ya no habrán etapas inmediatas de revisiones u observaciones adicionales.
La aplicación de este segundo filtro, entrega como resultado que del total de PRC seleccionados (291) y sometidos a EAE en el país para el periodo estudiado han llegado a dictarse la "resolución de término" y de "aprobación del instrumento" en 100 de ellos.

Atendido que la población de Chile se concentra principalmente en las regiones de Valparaíso, Metropolitana y Bío-Bío, y que esta concentración de los centros

urbanos se sitúa en torno a la zona mediterránea, reconocida como *hotspot* de biodiversidad tanto por su endemismo como por la amenaza a su conservación (Pauchard et al., 2006), se consideraron solo los PRC dictados en estas 3 regiones, correspondiendo éste al cuarto filtro y obteniendo un total de 51 PRC. El clima mediterráneo es muy frágil por lo que la urbanización puede tener impactos críticos en áreas con este tipo de clima, dada la contaminación, impermeabilización de los suelos, aumento de la escorrentía y riesgos asociados (Jiménez et al., 2020).

Finalmente, se revisaron las resoluciones de términos y las resoluciones de aprobación de cada PRC, con el objeto de identificar los indicadores de seguimiento ambiental que fueron utilizados en el marco de la EAE, atendido que es un requisito legal para la aprobación del respectivo PRC y con los indicadores ya identificados se clasificaron uno por uno. La clasificación se realizó a través de una identificación del indicador y contraste con los criterios OECD y los indicadores de la norma ISO 37120.

Capítulo III: Análisis Comparado de Normativas de Seguimiento de Instrumentos de Planificación Territorial en el Proceso de Evaluación Ambiental Estratégica

En el presente capítulo se muestran los resultados de un primer artículo científico, en estado *enviado,* a la revista ***Land Use Policy***.

A COMPARATIVE REGULATORY ANALYSIS OF STRATEGIC ENVIRONMENTAL ASSESSMENT FOLLOW-UP

Abstract
The incorporation of the environmental variable into land use planning instruments has been concentrated in phases prior to decision-making, despite the fact that after the strategic decision has been made, it is also necessary to follow-up on the environmental impacts or effects produced by the plan, as well as the possibility of adopting measures to correct them when they cause adverse or unforeseen effects. The form taken by this follow-up will vary from country to country, based on the respective legal system. The objective of this study is to understand these forms of follow-up in urban land planning instruments, comparing Chilean regulations with those in France and Portugal, through 3 research questions focused on determining whether this phase exists, whether it is possible to modify the planning instrument in the event of adverse effects and whether there are offset measures for those effects. This study shows that there is a significant gap compared to the regulations in France and Portugal, as the Chilean planning instruments cannot be adapted, nor are there any regulations in Chile aimed at offsetting adverse environmental effects.

Keywords
Strategic Environmental Assessment; Planning urban; planning land-use; urban environmental effects; follow-up.

1. Introduction.

Since the beginning of civilisation, human activities have had different effects on the environment, as a result of changes in land use (Turner et al., 2004, pp.227-244), which have altered ecosystems. Despite advances in understanding the characteristics and dynamics of these alterations, there is still the challenge of developing a systematic understanding of land use changes and their effects on biogeochemical cycles, ecosystem functions and/or services and human well-being (Committee on Grand Challenges in Environmental Sciences, 2001), for which multiple temporal and spatial scales should be considered (Alberti, 2005, pp 168-198).

The term land use change encompasses different human activities, from agricultural, forestry and reservoir uses to urban uses (DeFries et al., 2004, pp.1-9). For example, the Millennium Ecosystem Assessment (MEA, 2005) focuses on deforestation, dryland degradation, agricultural expansion and abandonment and urban expansion. With regard to the latter, the increase in the population living in urban areas is a growing global trend (Buettner, 2015, pp.91-108); the world's population is estimated to be 68% urban by 2050, with 6.7 billion urban dwellers

(United Nations, 2019).

Among the environmental effects of urban use, there is evidence associated with air pollution, which causes a wide range of effects on people's health, from eye irritation to death (Cohen et al., 2004, pp.1353-1434); and alterations to hydrological processes, through the expansion of impermeable zones, which has led to increased runoff rates and infiltration losses (Fletcher et al., 2013, pp.261-279), alterations in groundwater-surface water interactions (Price, 2011, pp.465-492), or modifications in the chemical and physical composition of water sources in urban areas that are substantially different from those in rural areas (Niemczynowicz, 1999, pp.1-14), degrading water quality and increasing both nutrients and microbial loads (Rashid et al., 2018, pp.67-74). Biodiversity is also affected by urbanisation, through the loss of native species, invasion of non-native species, severe soil erosion (Hansen et al., 2012, pp.277-299) the fragmentation of habitats and landscapes and their connectivity (MEA, 2005), or the effect on certain ecoregions in which more than a third of the area has been urbanised, thereby endangering 12% of the world's terrestrial vertebrate species, as well as increasing the likelihood that a vertebrate will be classified as threatened if a species' range is urbanised (Mcdonald et al., 2008, pp.1695-1703), with the consequent impact on the different ecosystem services that originate in ecological processes (Wade, 2019). Bartone et al. (1994) indicate that disruptions in urban land markets and ineffective land management policies and practices in developing countries have also led to other phenomena, such as the occupation of hazard-prone areas (e.g., steep slopes, floodplains and wastelands adjacent to polluting industries or waste disposal sites); and the loss of cultural resources, open spaces and prime agricultural land.

This diversity of factors necessitates land use planning by the state, the aim of which is to select and implement land uses that best meet the needs of the population, while safeguarding resources for the future (FAO, 1993). However, as there may be different interests or visions about the use that should be made of a particular location, the challenge for the state in this planning role involves the direct or indirect consideration of those interests or visions (Needham et al., 2006).

These state plans for land use, including urban land use, are implemented through tools such as policies and plans (as will be seen below with the countries analysed), the regulatory provisions of which have gradually incorporated (Cutaia, 2016) environmental protection objectives in order to recognise interactions between different land uses and their effects on the environment, through Environmental Impact Assessment (EIA) or the more modern Strategic Environmental Assessment (SEA). Since the 1960s and 1970s, EIA has been utilised to incorporate the environmental variable into the decision-making process of certain policies, plans, programmes and, in particular, investment activities or projects (Wood et al., 1992, pp.3-22; Partidario, 1996, pp.31-55; Van Der Vorst et al., 1999, pp.1-26; Nilson et al., 2001, pp. 305-327). The limitations of EIA, as recognised (Therivel, 1993, pp.145-168; Feldmann, 1998 pp.20-24), led to SEA, considered to be the appropriate route for identifying – in a formalised assessment process, at an early stage – the environmental impacts of decisions made at a policy, plan and programme level (Partidario, 1996, pp.31-55); and a tool that makes it possible to link the degradation of nature with the sustainable development objectives of poverty reduction (Organisation for Economic Co-operation and Development, OECD, 2010); as well as recognising its influence

on the choice between development alternatives during the early phases of decision-making. In other words, SEA can facilitate a proactive approach in order to ensure that environmental and sustainability considerations are taken into account during the initial phases of a strategic decision-making process (Fundingsland et al., 2012, pp.15-24) (a collection of different SEA definitions can be found in Noble et al., 2017, pp.165-173)

The incorporation of the environmental variable (whether EIA or SEA) has been concentrated in analyses prior to decision-making (Arts et al., 2001, pp.175-185), although after the strategic decision has been made (for example, a plan regulating urban land use), it is also necessary to follow-up on the environmental impacts or effects ultimately produced by the plan, whether they are positive or adverse, direct or indirect, cumulative or synergistic, foreseen or unforeseen (Odagiu et al. 2008, pp. 25-28).

These effects occur in an ex-post phase following the decision and its corresponding implementation, which in this study we call the follow-up phase, in line with Arts et al. (2001), which includes activities such as monitoring, auditing, ex-post evaluation, post-decision analysis or post-decision management; i.e., the range of activities that take place after the approval of a plan, policy or programme (PPP), including the following: a) Oversight of the effects after the decision; b) assessment of the results of the PPP; c) feedback; d) management thereof (enabling the rectification of the plan when certain adverse environmental effects are observed); and e) communication (Gachechiladze et al., 2009, pp. 45-56). These steps are considered key to increasing the effectiveness and credibility of SEA as a tool for integrating environmental sustainability into decision-making (Persson et al., 2007, pp.473-496), or as an element necessary for SEA to achieve its objectives with regard to the sustainability of the instruments subjected to it (Gachechiladze et al. 2012, pp.22-30). Ultimately, only with such a comprehensive follow-up will it be possible to make effective and timely progress on the challenges established as objectives.

It has already been observed that SEA follow-up is becoming more complex. As described by Cherp et al. (2011), the importance of SEA follow-up lies in the fact that uncertainties in determining the environmental implications of an initiative are typically more acute than those encountered with respect to the environmental impacts of an individual project; and it is likely that new circumstances will arise as a result of a strategic initiative whose scope of application is less controlled by the proponent than by the operation of a project; and deviations from the initial designs are more common in strategic initiatives than in projects.

The form taken by follow-up, encompassing the activities described above, will vary from country to country, according to how it is regulated in the respective legal system. For example, although the European Union incorporates SEA and the corresponding follow-up in Article 10 of Directive 2001/42/EC – the SEA Directive (2001) – it nonetheless grants a significant degree of flexibility to each member country to establish rules specific to their reality (Persson et al. 2007, pp.473-496). In Annex I, there is a description of the measures envisaged for “monitoring” the effects of the plans and programmes, in order to, inter alia, promptly identify unforeseen adverse effects and allow appropriate remedial action to be undertaken. Annex I(g) identifies, among the information to be provided, the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effect on the environment resulting from the

implementation of the plan or programme. The regulation is quite comprehensive, although it has been observed that while it explicitly stipulates monitoring, it only indirectly refers to assessment (implicit in “to identify at an early stage unforeseen adverse effects”) and management (implicit in “to be able to undertake appropriate remedial action”) and does not mention communication at all (Cherp et al., 2011, pp. 515-534).

In the case of Chile, SEA is introduced in 2010 after a legal reform, following recommendations from the OECD (2005), with the objective of assessing plans that regulate land use, whether they are being enacted for the first time or are substantial amendments to existing instruments (Biblioteca Congreso Nacional, available online: http://bcn.cl/2f707). In 2005, the OECD reported that Chile’s current spatial planning instruments have not been able to prevent the environmental stress caused by land use changes and that there are still problems such as uncontrolled urban expansion and factories located in environmentally sensitive areas or areas vulnerable to natural disasters; it thus recommended a more coordinated approach to land use planning (OECD, 2005). After the legislative changes, a regulation established certain rules for following up on the plan under assessment. Nonetheless, despite the incorporation of SEA in Chile, this same international body has subsequently stated that there is little evidence that SEA has significantly contributed to modifying spatial development plans in order to better mitigate environmental problems in urban areas (OECD, 2016).

Following this diagnosis, and after more than a decade of SEA being implemented in Chile, it is necessary to review the regulatory differences with other countries in terms of follow-up, in order to identify aspects in which Chile could make advances towards better follow-up of the environmental effects of its spatial planning instruments.

The objective of this study is to understand the regulations for the follow-up phase of the instruments that regulate urban land use planning, comparing the regulatory design of the follow-up model established in Chile with the design established in two other nations in the European Union, through 3 questions that will be answered based on the current regulations of the countries selected. In addition, brief references will be made to the spatial planning instruments that could address non-urban land use planning.

2. Methodology.

The methodology of this investigation is based on a comparative review of the regulations established in France, Portugal and Chile for the spatial planning instruments (SPI) in use in each country. Starting from the premise (previous section) that SEA is the instrument par excellence for incorporating the environmental variable into the development of SPIs, the general regulations of the spatial planning instruments and the SEA systems will be examined.

These countries were selected based on the following criteria. First, Chile signed an agreement with the European Union to compile the lessons learned from the European Union’s experience with SEA, in order to contribute to the implementation of this tool in Chile (Gobierno de Chile, Ministerio de Medio Ambiente). Second, it was necessary to consider that Chile, as a unitary country, has developed regulations on SEA that are implemented nationally (spatial aspect) and that these regulations have a legal status (legislative hierarchy aspect). Consequently, federal countries that allow sub-national entities to

develop specific regulations for themselves are excluded, as is the case with countries such as Germany, Spain and Italy. Moreover, all three countries are part of the OECD and are therefore subject to assessments by the same international body.

Based on the regulations in effect in each of the countries selected, the following three research questions were answered:

1. Does the SEA process of the spatial planning instrument include the follow-up phase for the environmental variables that may be affected by the respective instrument?
2. Are there provisions establishing the need to modify the spatial planning instrument as a consequence of following up on the environmental variables, in order to prevent undesired effects or effects different from those originally considered?
3. Does the SEA process require the spatial planning instruments to include offset measures for adverse environmental effects produced by the respective instrument?

Prior to each question, the applicable regulations will be identified.

3. Results.

This section will present the answers to the research questions, performing an analysis for each country selected.

3.1. France.

3.1.1. Identification of the legislation analysed in France.

The regulation of SEA in France is primarily contained in two legal texts: The Urban Planning Code and the Environment Code.

The Environment Code lists the plans and programmes with a significant impact on the environment, which must be subjected to a strategic environmental assessment, with assessment understood as a process that involves the preparation of a Report on the environmental impacts, consultations being carried out, this report and these consultations being considered during decision-making by the authority adopting or approving the plan or programme, as well as information being published about the decision (Article L-122-4) (Légifrance, Code de l'environnement).

The Urban Planning Code (Huybrechts, 2020, pp.357-375) regulates the plans for programmes related to land use, for the entire national territory, with the exception of the overseas communities governed by Article 74 of the Constitution –New Caledonia and the French Southern and Antarctic Territories – in accordance with the specific provisions governing those territories, as stipulated in Article L-101-3. It also provides for the following planning levels, each with its own regulations: At a regional level, the “directive territoriale d'aménagement et de développement durables”, which corresponds to the territorial directives for planning and sustainable development; then, at a metropolitan level, the “Schéma de cohérence territoriale” or Territorial Cohesion Plans; finally, at a municipal level, there are two types of instruments depending on whether there is a set of municipalities where the “Plan local d'urbanisme intercommunal” or inter-communal urban plans are in place or, if there is a municipality, communal or local urban plans (OECD, 2017). As the OECD indicates, inter-municipal associations of large urban areas play an important role in the French planning system and municipalities are responsible for creating local land use plans and issuing building permits (Légifrance, Code de l'urbanisme).

3.1.2. Analysis of research questions.

First Question: Does the SEA process of the spatial planning instrument include the follow-up phase for the environmental variables that may be affected by the respective instrument?

Yes. The different types of instruments mentioned above must be subjected to an environmental assessment (Article L-104-1 Code de l'urbanisme), in which the environmental report must contain the criteria, indicators and methods used to monitor the effects of the instrument on the environment, in order to identify, in particular, at an early stage, the unforeseen negative impacts and to consider, if necessary, appropriate measures (Article R-104-18 of the Urban Planning Code No. 5 and 6).

Second Question: Are there provisions establishing the need to modify the spatial planning instrument as a consequence of following up on the environmental variables, in order to prevent undesired effects or effects different from those originally considered?

To answer this question, a distinction must be made between the different levels of spatial planning in the French Urban Planning Code.

First, the Territorial directives for planning and sustainable development may determine the objectives and guidelines of the state in the areas of urban planning, housing, transport and travel, development of electronic communications, economic and cultural development, public spaces, trade, preservation of areas, sites and landscapes (natural, agricultural and forest), consistency of ecological continuity, improvement of energy efficiency and reduction of greenhouse gas emissions in areas with national challenges in one or more of these areas, as stipulated in Article L-102-4 of the Urban Planning Code. These directives are therefore a planning tool for large territories with national challenges, which demand a specific intervention by the state, and their guidelines are framed in terms of regional planning around three main axes of reflection: large state infrastructure and transport projects; the preservation of natural spaces; and a balanced development of the territories within their borders (Amarouche, 2019). Although it is a non-binding instrument, in the context of land use planning (Charmes, et al., 2020, pp-1-17; Lindblad, 2020), Article L-143-29 of the Urban Planning Code establishes the obligation to revise the Territorial Cohesion Plan when there are changes to the guidelines defined by the Territorial Directives for Planning and Sustainable Development.

Then, there are Territorial Cohesion Plans, incorporated in 2000 by the Law known as “Solidarité et au Renouvellement Urbains” (SRU) (Breuillard et al., 2007, pp.50-66), the purpose of which was to give cohesion to the proliferation of sectoral planning documents that had been produced and revitalise strategic spatial planning at the local level by describing development strategies and objectives for the territory (Bigard et al., 2020, pp.1-12). These Plans seek to assess the compatibility of the desires for a physical area (Novarina et al., 2009, pp.18-27) and the transformations it experiences and can encompass several cities or groups of existing cities (François, 2011, pp.110-115). Furthermore, it seeks to ensure cohesion between different sectoral policies at the local level, following a logic of environmental protection and sustainable development (Maturana, 2014, pp.72-92) Territorial cohesion plans are not binding upon third parties but upon the local administration, in accordance with a compatibility report that grants ample freedom to the authors of the plan. Nonetheless, Article L-131-

4 of the Urban Planning Code establishes that the local urban plan (which we analyse below), corresponding to a lower level as indicated, must be compatible with the territorial cohesion plans. Moreover, Article L-131-6 establishes that in cases where the local urban plan, or the document that replaces it, or the municipal plan, is approved prior to a Territorial cohesion plan, it must be made compatible with it, as necessary, within a period of one year (in the case of a Territorial cohesion plan) or within a period of three years (if compatibility implies a revision of the local urban plan or the document replacing it), and is therefore a relevant instrument (Geppert, 2015, pp.381-410).

However, these Territorial Cohesion Plans can be revised. The regulations stipulate that, no later than six years after their approval, the corresponding public body must analyse the results of the plan's application in a number of aspects, including the environmental, and must deliberate about whether to keep it in effect or revise it partially or entirely (Article L-143-28). In the absence of that deliberation, the territorial cohesion plan is null and void (Article L-143-28 of the Urban Planning Code).

With regard to Local Urban Plans (Plan Local d'Urbanisme - PLU), these instruments determine building rights (Gralepois, 2020), such as construction, size, outdoor areas, and the organisation of the space (function, land reserves for equipment, etc.), as well as ensure that the local objectives of the territorial directives for planning and sustainable development and the general objectives of the PLU defined by law are respected. These plans can have an inter-communal scope when agreed upon by public institutions for inter-communal cooperation. In addition, they too must be revised. According to Article L-153-27, no later than nine years after the deliberations by which the plan was approved, or the deliberations by which it was completely revised, or the deliberations by which it was decided to maintain it, an "Analysis of the Results of the Plan's Application" will be carried out, addressing the objectives mentioned in Article L-101-2, in which the environment and climate change are duly represented: The prevention of foreseeable natural risks, mining risks, technological risks, pollution and disturbances of all kinds (Objective 5); the protection of the natural environments and landscapes, the preservation of the air, water, soil and subsoil, natural resources, biodiversity, ecosystems and green spaces, as well as the creation, preservation and restoration of ecological continuity (Objective 6); the fight against climate change and the adaptation to this change, the reduction of greenhouse gas emissions, the conservation of fossil fuels, energy management and the production of energy from renewable sources (Objective 7).

Similarly, Local Urban Plans are subject to revision in the cases stipulated in Article L-153-31 of the Urban Planning Code, which include a change in the guidelines defined by the planning and sustainable development project; the reduction of a designated wooded area, agricultural area or natural wooded area; or the reduction of a protection measure enacted because of the risks of disturbance, the quality of natural sites, landscapes or environments, or a change of such a nature that it leads to serious risks of disturbance. It also establishes that nine years after the approval of the local urban plan, an analysis of the results of the plan's application will be carried out, addressing the objectives mentioned in Article L. 101-2, which governs the general objectives that must be followed by the instruments regulated by the Urban Planning Code (in which we highlight number 6 of the aforementioned article, which provides for the protection of

natural environments and landscapes, the preservation of the air, water, soil and subsoil, natural resources, biodiversity, ecosystems and green spaces as well as the creation, preservation and restoration of ecological continuities). The analysis of the results also includes, where appropriate, the new tourist units mentioned in Article L. 122-16 of this Code.

The Regulations of the Urban Planning Code provide for other circumstances – very important – in which the environmental assessment of the local urban plans will be carried out, including revision, modification or compatibility in the context of a declaration of public utility or declaration of a project permitting constructions, developments, structures or public facilities that may significantly affect a Natura 2000 site (Art. R-104-8, No. 2). According to Prevóst et al (2012), the State has become very strict about the quality of this assessment when the area is related to a Natura 2000 site. Furthermore, the state can cancel the plan if it considers the quality of the research to be insufficient (as with the PLU in Bouguenais, which was cancelled in February 2011).

In turn, the French Environmental Code states that once the plan or programme has been adopted, the authority that adopted it must inform the public, the environmental authority and, where appropriate, the authorities of the other European Union Member States consulted, providing information on measures intended to assess the environmental impact of the plan or programme's implementation (Article L122-9).

Third Question: Does the SEA process require the spatial planning instruments to include offset measures for adverse environmental effects produced by the respective instrument?

The report presenting the environmental assessment that must be prepared for each of these instruments should contain measures intended to prevent, reduce and as fully as possible offset the negative impacts of the instrument, as established in Article 104-4 of the Urban Planning Code (Jiricka, 2008, pp.328-337).

3.2. Portugal

3.2.1. Identification of the legislation analysed in Portugal.

The regulation is contained in Decree Law No. 232/2007 of 15 June, which establishes the regime for assessing the effects of certain plans and programmes on the environment. Although it is recent, Portugal carried out SEA prior to those regulations, as was the case with the Portuguese Strategy for Integrated Coastal Zone Management (Estratégia Nacional de Gestão Integrada da Zona Costeira – ENGIZC) (Partidario et al., 2009, pp.1271-1275) or in Tróia (Melo et al., 2005, pp.91-98).

Article 3 establishes a list of plans and programmes to be subjected to SEA, including plans and programmes for the urban and rural or land use planning sectors, constituting a framework for the future approval of the projects mentioned in Annexes I and II of Decree-Law No 69/2000 (Diário da República eletrónico. Decreto-Lei nº 232/2007)

With regard to spatial planning, the legislation was initially located in Law No. 48/98, which established the principles of the spatial and urban planning policy, and is considered to be the first law to establish a framework for spatial planning (Carter et al., 2001, 341-370), defining different levels and types of subjects to be addressed in each instrument (Botequilha et al, 2009, pp.23-40).

This law was later repealed by Law No. 31/2014, which established the Law on the general public policy principles for land, spatial and urban planning (Abrantes et al., 2016, pp.120-134) and is further developed by Decree-Law No. 80/2015, which approves the revision of the Legal Framework for Land Management Instruments, approved by Decree-Law No. 380/99 of 22 September.

The land use regime is established through inter-municipal or municipal spatial plans (there are 278 municipalities according Pereira et al. (2020), that classify and describe the land, thus determining the basic purpose of the land, respecting its nature, based on the distinction between rural and urban land (Art. 12 of Law No. 31/2014). Land use is defined exclusively by inter-municipal or municipal spatial plans, through the definition of construction areas or, failing that, through the application of quantitative and qualitative parameters or indices for use or buildability, in terms of law (Art. 20 of Law No. 31/2014).

3.2.2. Analysis of research questions.

The research questions will be answered below, based on the regulations identified above.

First Question: Does the SEA process of the spatial planning instrument include the follow-up phase for the environmental variables that may be affected by the respective instrument?

Yes, both the SEA system and the specific regulations for the aforementioned instruments provide for this type of measure.

The environmental report within the SEA process must identify, describe and assess the potential significant effects on the environment resulting from the application of the plan or programme, its reasonable alternatives considering the objectives and the respective territorial scope, and contain elements such as the probable evolution if the plan or programme is not applied. This report should also contain a description of the control measures envisaged, in accordance with Article 11.

Article 11 contains the regulations on the control measures that are presented in the environmental report, establishing the duty of the body responsible for the programme or plan to assess and control the significant environmental effects resulting from its application and implementation, verifying the adoption of the measures stipulated in the environmental declaration, in order to identify unforeseen adverse effects in a timely manner and rectify them. Moreover, the results of the control must be published electronically by the corresponding bodies and updated at least once a year and must also be sent to the Portuguese Environment Agency.

In turn, the regulations governing the spatial planning instruments establish that all spatial programmes and plans must define parameters and indicators that make it possible to follow up on the respective strategy, objectives and results of their implementation (Article 57, No. 1, Law No. 31-2014). This task is assigned to the state, the autonomous communities and the local authorities, which must collect information and facilitate the preparation of the respective implementation reports, as well as the standardisation of the data sources and common indicators, within the period and under the conditions stipulated by law. This implementation report may result in the need to amend, revise or revoke a spatial programme or plan (Article 57, No. 2 and 3 of Law 31-2014). To ensure this follow-up, the law establishes forms of ongoing monitoring and technical assessment of the land management and provides mechanisms to ensure the efficiency of the instruments that implement it (Article 73, No. 1, Law No.

31/2014); it also establishes the creation of a national spatial information system that provides data on the territory, organised at the national, regional and local levels (Article 73, No. 2, Law No. 31/2014); and finally, it creates a national registration information system that enables the identification of construction units (Article 73, No. 3, Law No. 31/2014).

Article 4 of Decree-Law No. 80/2015 states that all spatial programmes and plans must contain qualitative and quantitative indicators for the purposes of the assessment stipulated in Chapter VIII. This requirement for indicators is then adopted in the specific regulations for each of the instruments that were examined. Thus, Article 33 of Decree-Law No. 80/2015 states that the national spatial planning policy programme is a programme of action that must contain qualitative and quantitative indicators that support assessment, which is also required for the regional and inter-communal programme reports, the municipal master plan, the urban plan, and the comprehensive plan, in accordance with Articles 55, 64, 97, 100, and 107, respectively Diário da República eletrónico. Decreto-Lei nº 80/2015.

All the articles cited in the previous paragraph require the inclusion of qualitative and quantitative indicators that support the assessment stipulated in Chapter VIII, which corresponds to Articles 187 et seq. of Decree-Law No. 80-2015. Paragraph 2 of that article establishes the objective of the indicators as follows: “In the programmes and plans subjected to environmental assessment, it is necessary to ensure that the significant effects of their implementation on the environment are assessed, in order to identify unforeseen negative effects and apply the necessary corrective measures stipulated in the environmental declaration”.

Then, Article 188 allows for modifications resulting from the assessment of municipal and inter-municipal plans, as long as they are undertaken for some of the objectives mentioned in the regulations, which include promoting the improvement of the quality of life and protecting environmental and landscape values.

Second Question: Are there provisions establishing the need to modify the spatial planning instrument as a consequence of following up on the environmental variables?

To answer this question, the different levels and instruments of Portuguese spatial planning should first be identified. It is thus necessary to examine Title III of Law No. 31/2014, which establishes the land management system, the structure of which uses instruments that are: a) Programmes, which establish the strategic framework for territorial development and its programmatic guidelines or define the spatial impact of the national policies to be considered at each planning level (Article 38, No. 1(a) of Law No. 31/2014); b) Plans, which establish concrete options and actions for the planning and organisation of the territory, as well as the definition of land uses (Article 38, No. 1(a) of Law No. 31/2014).

At the national level, the National Spatial Planning Policy Programme (Programa Nacional da Política de Ordenamento do Território – PNPOT) establishes – in the implementation of European territorial development options, within the European framework – the strategic options for national spatial planning and the model for territorial organisation, considering the urban system, infrastructure and public facilities for collective use in the national interest, as well as areas of national interest in terms of national defence and public security, agriculture, forestry, the environment, cultural heritage and economics, the

exploitation of geological resources and the use of renewable energies (Article 40, No. 2(a), Law No. 31/2014). Portugal has its own national spatial planning programme (PNPOT) through Law No. 58/2007, which identifies 24 key land use issues and different priorities for the measures that should be applied (Pena et al., 2018, pp.543-553), which was modified for the first time in 2019 through Law No. 99/2019, of 5 September.

At the regional level, the instruments are called Regional Programmes and are the strategic framework for the development of Inter-municipal Programmes and Inter-municipal and municipal spatial plans (Article 41, No. 2, Law No. 31/2014), which will establish the strategic options for regional spatial planning and the respective model for territorial organisation, considering the urban system, infrastructure and public facilities for collective use in the regional interest, as well as areas of regional interest in terms of agriculture, forestry, the environment, ecology and economics, integrating the national networks of infrastructure, mobility and public facilities for collective use from the regional standpoint (Article 41, No. 1, Law No. 31/2014).

The inter-communal level may encompass two or more contiguous municipalities that are spatially integrated into a single inter-municipal community, with certain exceptions established by that law, but this level is optional (Article 42), and its existence does not affect the right of each municipality to manage its territory autonomously, in accordance with the provisions in that plan.

Spatial plans at the municipal level are binding upon both public bodies and individuals, and their objectives include the definition of the ecological structure, with the aim of protecting and improving the municipal environment. The Municipal Plan has 3 types of instruments: the municipal master plan, the urban plan and the comprehensive plan, which are developed by the municipal council and approved by the municipal assembly (Article 48), and establish the spatial planning regime and the respective implementation. In detail, the municipal master plan establishes the municipal territorial development strategy, the municipal land policy, the spatial and urban plan, the municipal territorial model, the options for the location and management of public facilities for collective use and interdependent relationships with neighbouring municipalities, integrating and coordinating the guidelines established by the national, regional and inter-municipal programmes (Article 95, No. 1, Decree Law No. 80-2015). Next, the urban plan develops and implements the municipal master plan and structures land occupation and land use, providing the framework for the application of urban policies and defining the location of key infrastructure and public facilities for collective use (Article 98, No. 1, Decree Law No. 80-2015). Finally, the comprehensive plan develops and specifies proposals for the occupation of any area in the municipal territory, establishing regulations for the execution of infrastructure projects and the design of spaces for collective use, building construction, size and codes and the rules for their integration into the landscape, the location and urban integration of public facilities for collective use and the spatial organisation of other activities in the general interest (Article 101, No. 1, Decree Law No. 80-2015).

With regard to the possibility of modifying the instruments identified above, Article 50 of Law No. 31/2014 establishes that spatial programmes and plans may be subject to revision, alteration, suspension or revocation “due to the evolution or reappraisal of the economic, social, cultural and environmental

conditions" that underlie their development, based on an Assessment Report that must be prepared in accordance with the terms established by law.

At the national level, the government prepares a report every two years regarding the state of the spatial planning, which is submitted to the Assembly of the Republic (Article 189, No. 1 of Decree-Law No. 80-2015). It consists of an assessment of the implementation of the national spatial planning policy programme and the guiding principles and methods for coordinating sectoral and regional policies with a territorial impact, as indicated in Article 72 of Law No. 31/2014.

At the regional level, the regional coordination and development commission prepares a report every four years on the status of the regional planning, which is submitted to the respective supervisory body (Article 189, No. 2 of Decree-Law No. 80-2015). Consequently, the examination of the regional programmes aims to adapt the strategic options that determined their development, considering the aforementioned report on the status of the spatial planning (Article 124, No. 1 of Decree-Law No. 80-2015).

At the inter-municipal and municipal levels, the municipal council, the metropolitan executive commission, the inter-municipal council or the municipal councils of the associated municipalities prepare a report every four years on the state of the spatial planning (Article 189, No. 3 of Decree Law No. 80-2015). At both the inter-communal and communal levels, the plans will be revised based on the need to adapt them to the medium- and long-term evolution of the environmental, economic, social and cultural conditions that determined their development, considering the reports mentioned above (Article 124, No. 2 of Decree-Law No. 80-2015). In any case, at the inter-municipal and municipal levels, this revision can only be done three years after the plan comes into effect.

With regard to the validity of the municipal plans, Article 93, No. 2 of Decree-Law No. 80-2015 states that they must be revised when the respective follow-up and assessment – reflected in the state spatial planning reports – identify implementation levels and an evolution of the environmental, economic, social and cultural conditions that underlie them, which could lead to a modification of the territorial model established.

Furthermore, the spatial plans and programmes may be revoked when the assessment of the evolution of the environmental, economic, social and cultural conditions determines that it is necessary, as established in Article 127.

Third Question: Does the SEA process require the spatial planning instruments to include offset measures for adverse environmental effects produced by the respective instrument?

In terms of offset, the regulations of the SEA system establish the need to define this type of measure, as Article 6 of Decree Law 232-2007 indicates that the authority responsible for the instrument must prepare the environmental report, which includes measures to prevent, reduce and as fully as possible eliminate any significant harmful effect on the environment resulting from the implementation of the plan or programme.

Moreover, Law No. 31/2014 establishes the principle of responsibility, as it indicates that the land use instruments must guarantee an assessment prior to interventions with a relevant impact on the territory, considering the duty to restore or offset the damages that threaten the natural, cultural and landscape heritage (Article 31).

Finally, Article 12 of Law No. 31/2014 indicates that the State, Autonomous

Communities and Local Entities must identify – in the spatial programmes and plans – the territorial spaces to be rehabilitated and regenerated and promote appropriate actions to pursue those objectives, irrespective of whether the land is rural or urban.

3.3. Chile

3.3.1. Identification of the legislation analysed in Chile.

In 2010, through a reform introduced by Law No. 20,417/2010 to Law No. 19,300/1994, establishing the General Framework for the Environment (Las Bases Generales del Medio Ambiente - LBGMA), SEA was adopted in Chile, as well as the requirement of subjecting spatial planning policies, plans and instruments to it, which entailed "introducing environmental assessment into the public planning process, integrating environmental and sustainability considerations into the design, approval and follow-up of policies and plans" (Ramírez, 2010, pp.57-73). The regulations of the SEA system in Chile are located in Supreme Decree No. 32 of 2015 of the Ministry of the Environment (D.S. No. 32/2015).

The LBGMA establishes the definition of SEA in Article 2(i) bis, namely: "the procedure carried out by the respective sectoral Ministry to ensure that the environmental considerations of sustainable development are incorporated into the formulation process for policies and plans of a general regulatory nature, which have an impact on the environment or sustainability, such that they are integrated into the enactment of the respective policy and plan, and any substantial modifications thereto". Although the instruments are subjected to SEA on a voluntary basis, following a decision made by the body responsible for the policy or plan, and approved by a Council of Ministers for Sustainability, in the case of the spatial planning instruments, Article 7 bis, paragraph 2 of the LBGMA states that regional spatial plans, inter-communal regulatory plans, communal regulatory plans and sectoral plans, regional plans for urban development, the zoning of coastal areas and the maritime territory and integrated watershed management, or the spatial planning instruments that replace or systematise them, must always be subjected to SEA. With regard to those instruments, the procedure and their approval will be the responsibility of the Ministry of Housing and Urbanism, the Regional Government or the Municipality, or any other state administration body, respectively.

With regard to the regulation of the spatial planning instruments, they are regulated by the General Law on Urbanism and Construction (Ley General de Urbanismo y Construcciones – LGUC, available online: http://bcn.cl/2f7k6) and its General Ordinance (Ordenanza General - OGUC). These regulations are restricted to the urban area and their objective is to guide and regulate the development of urban centres in accordance with a national, regional and communal policy for socio-economic development (Art. 27, LGUC). Urban planning is carried out at three levels of action, corresponding to three types of area: national, inter-communal and communal.

With regard to the zoning of coastal areas and the maritime territory, following Cordero (2007), there is a National Policy for the Use of Coastal Areas, a coordinating body established by the central government, which was approved by D.S. No. 475 of 11 January 1998, of the Ministry of National Defence, with the objective of carrying out an integrated planning of the maritime and land areas adjacent to the coast, and which is not binding. Its objectives include the protection and conservation of the maritime, land and air environment, in

accordance with the development needs and the other policies established on these matters (Art. 1, D.S. No. 475, of 11 January 1998). In the case of integrated watershed management, there are no regulations in effect in Chile at present (Maturana, et al., 2017, pp.181-208).

It is also important to mention Law No. 21,074 of 2018, which amends the Law on Regional Government and Administration that created the Regional Land Management Plans, which will be analysed below.

3.3.2. Analysis of research questions.

First Question: Does the SEA process of the spatial planning instrument include the follow-up phase for the environmental variables that may be affected by the respective instrument?

With respect to the follow-up or monitoring functions in the Chilean SEA system, the environmental report that describes the application of SEA, which must be prepared by the body responsible for submitting it to the Ministry of the Environment, should include a number of different aspects, among them: the identification of follow-up indicators, i.e., the set of analytical elements directed towards understanding and assessing – within a given time frame – the results of the implementation of the spatial planning instrument subjected to SEA (Article 21(l)) D.S. No. 32/2015 . Available in: http://bcn.cl/2faef) .

This report may receive comments from the environmental authority, with the objective of modifying the contents of the instrument, although the body responsible does not have to accept these comments, justifying the rationale, which is enough for the SEA process to continue (Article 23, D.S. No. 32/2015). Once the comments have been resolved, the Body Responsible will issue a resolution ending the SEA process, which must include the identification of the follow-up criteria and indicators directed towards controlling the results of the plan, as well as the redesign criteria that must be considered for its reformulation. The redesign criteria comprise a set of analytical elements, derived from the follow-up criteria, directed towards understanding and assessing – within a given time frame – the need to modify or reformulate a spatial policy, plan or instrument subjected to SEA.

Consequently, the redesign criteria will establish the need to modify or reformulate the instrument, emerging from the follow-up criteria that are aimed at controlling the results of the plan. However, there is no explicit definition of what is meant by “results of the plan”, and whether it includes environmental aspects. In this sense, it would be sufficient to establish follow-up criteria for the urban planning objectives of the plan.

Second Question: Are there provisions establishing the need to modify the spatial planning instrument as a consequence of following up on the environmental variables?

To address this question, it is necessary to identify the different spatial planning levels and instruments in use in Chile.

At the national level, there is still no instrument that establishes a national planning system (Cordero, 2015, pp.93-138). There is only the National Urban Development Policy, which has an indicative nature, setting out principles, objectives and lines of action for planning instruments at lower levels (inter-communal and communal) (Rajevic, 2001, pp.81-100). At an inter-communal level, the corresponding instrument is the Inter-Communal Regulatory Plan (Plan Regulador Intercomunal - PRI), which guides and regulates urban areas (and zones of urban expansion) for agglomerations of two or more communes, not

exceeding 500,000 inhabitants, which comprise an urban unit; when the urban agglomeration exceeds this threshold, the instrument is called the Metropolitan Regulatory Plan (Plan Regulador Metropolitano - PRM) (Rajevic, 2001). At the communal level, Article 41 of the LGUC establishes that Communal Urban Planning promotes the harmonious development of the communal territory, particularly its population centres, in accordance with the regional goals of economic and social development, through the instrument of the Communal Regulatory Plan, which according to its legal definition, is comprised of a set of regulations on adequate conditions for hygiene and safety in buildings and urban spaces, and comfort in the functional relationship between residential and commercial zones, public facilities and leisure areas (Article 41, LGUC). This instrument establishes land use or zoning, the location of community facilities, parking, the hierarchy of road structures, the definition of urban limits, densities and the determination of priorities in the urbanisation of land for the city's expansion, depending on the feasibility of expanding or establishing health and energy networks, and other urban planning aspects. Both the communal and inter-communal levels are binding regulations upon the public and private administration. Also regulated by the LGUC are sectoral plans, which are an instrument with a municipal origin – as is the case with communal regulatory plans – but at a lower level (Rajevic, 2001). The LGUC indicates that when there is no Communal Regulatory Plan, Sectoral Plans can be studied, which has led to the conclusion that – legally – they are unique instruments (Figueroa et al. 2016).

Outside the framework above, given that their scope of action is not restricted to urban centres, as is the case with the instruments regulated by the LGUC, it is important to mention Regional Land Use Plans (Planes Regionales de Ordenamiento Territorial – PROT), defined as instruments that guide the use of the region's territory in order to achieve sustainable development through strategic guidelines and a macro-zoning of that territory. These are only binding in two aspects: i) when they establish location conditions for the disposal of different types of waste and their treatment systems; and ii) conditions for the location of infrastructure and manufacturing activities, but only in areas not covered by urban plans, as well as the identification of areas for their preferred location. However, legally PROTs are not currently in effect, until the national spatial planning policy and the respective regulations enter into force.

With regard to modification or revision processes included in the aforementioned spatial planning instruments, in the case of the national urban planning, Article 29 of the LGUC indicates that the Ministry of Housing and Urban Development, through the OGUC, will be responsible for establishing specific regulations for the study, revision, approval and modification of the legal instruments through which urban planning is implemented at the aforementioned levels. However, this OGUC does not establish regulations applicable to aspects of revision, monitoring or follow-up that would lead to an eventual modification of the instrument as a result of its environmental effects. For the National Urban Development Policy, it establishes "environmental balance" as one of the guiding principles of the policy, with the function of measuring and monitoring urban environmental variables. It thus promotes the creation and maintenance of an integrated registry of the natural resources in all the areas covered by the SPIs; the establishment of specific goals to improve the environment in cities, in areas such as efficiency in the use of natural resources, emissions of greenhouse

gases, waste management, acoustic, visual and light pollution, odours, and damage to buildings and the public space; the creation of a system of indicators for fulfilling the environmental objectives of the SPIs; and, finally, the establishment of incentives for compliance, mechanisms for adaptation and adjustment, and potential sanctions.

At the regional level, the Regional Urban Development Plans have been repealed, except for those already enacted, and the PROTs are waiting to enter into effect. With regard to those PROTs, the law establishes that they must be assessed and, when appropriate, updated, in cycles not exceeding periods of ten years, although without indicating specific causes or rationales for revision. The law also stipulates that regulations that have not yet been enacted will regulate procedures for developing, assessing and updating them. However, given that the law does not establish specific causes for assessment apart from the period of 10 years, the regulations cannot incorporate the adverse environmental effects that may be caused by a PROT as a rationale for assessment and updating, given that the only cause is compliance with the 10-year period.

At the municipal and inter-communal level, there are no regulations that establish the possibility for communal and inter-communal regulatory plans to be modified or revised as a result of the environmental effects caused by the instrument.

Third Question: Does the SEA process require the spatial planning instruments to include offset measures for adverse environmental effects produced by the respective instrument?

Neither the regulations of the SEA system nor those of the spatial planning instruments explicitly address this type of measure. As seen in the answer above, the criteria for redesigning the instrument consider the need to modify or reformulate it, based on the follow-up criteria that control the results of the plan; and it is not clear whether environmental aspects are explicitly included. If it were understood that they are included, it would still only lead to the conclusion that it is necessary to modify or reformulate the instrument, but there is nothing regarding measures for offsetting or even rectifying the adverse environmental effects caused by the respective spatial planning instrument.

4. Discussion.

The results show differences between the incorporation of environmental variables into the spatial planning instruments in a stage subsequent to their approval, although France and Portugal tend to have similar regulations.

With regard to the first question, it is important to remember that in the case of France and Portugal, their SEA systems follow common standards set by Directive 2001/42/EC of the European Parliament and Council for assessing the effects of certain plans and programmes on the environment. This Directive requires the submission of an Environmental Report containing the information required in Article 5 and Annex I and is submitted when the environmental assessment is requested. Annex I contains not only measures to prevent, reduce and offset adverse effects on the environment (Annex I(g)) but also a description of the measures envisaged for monitoring in accordance with Article 10 of the Directive, which is entitled “Monitoring” and, in detail, requires that the effects of the implementation of plans and programmes important for the environment be monitored in order to, inter alia, promptly identify unforeseen adverse effects and allow appropriate remedial action to be undertaken, as indicated in that provision.

Consequently, both France and Portugal have regulations that stipulate criteria, indicators and methods for analysing the environmental effects of the instrument (Article L-104-1 of the French Urban Planning Code) or the control measures (Article 11 of Portuguese Decree Law No. 232), along with specific regulations for each instrument, which require them to use qualitative and quantitative indicators to assess the significant effects of the instrument (Decree Law No. 80-2015). Chile answers this first question without much clarity, as the follow-up indicators are intended to assess the results of the plan, and thus in practice may lead to the requirement being fulfilled incorporating only urban indicators (such as population growth, green areas, transport) and non-environmental indicators (such as effects on groundwater (Delgado et al., 2017, pp. 4699-4713) or wetlands (Rojas, et al. 2019, pp 47-56), emission of atmospheric pollutants (Jorquera, 2020) and pressures on sustainability (OECD, 2013), among others, which is exacerbated by the fact that there is no monitoring of these instruments, and thus revision is voluntary and discretionary, based on the rationale of the authority (Gobierno de Chile- Consejo Nacional de Desarrollo Urbano, CNDU, 2019).

In the second research question, although France does not have regulations requiring that a planning instrument be modified in response to the environmental effects it may be producing, there are regulations that set deadlines for modifying the instruments, considering the environmental objectives to be achieved with these planning instruments. Furthermore, local urban plans (binding level) can be revised when there are modifications in measures that safeguard against serious risks of nuisance or protect the environmental quality of sites, as indicated in Article L-153-31. It also emphasises the protection of Natura 2000 sites, which is one of the most important biodiversity conservation networks in the world. Portugal answers the question with the possibility of revisions, alterations, suspensions or revocations when conditions are assessed or develop, within which are environmental issues, which must also be periodically reported by the bodies responsible for each instrument. Finally, Chile has not considered regulations that would allow its planning instruments to be adapted when they are producing unforeseen effects on the environment, although its national policy (which is not binding and has no studies on its implementation) establishes the need to make advances on environmental indicators. In any case, spatial planning instruments in Chile tend to be immutable (CNDU, 2019); although they can be developed through creation, modification and amendment schemes, they do not have specific, simplified procedures, which has resulted in communal regulatory plans having an average age of 19 years (CNDU, 2019). Recently, through a reform in 2018, it was established that spatial planning instruments must be periodically updated within a period no greater than ten years, in accordance with the regulations in the OG.

As for the third question, the differences between France and Portugal compared to Chile are even clearer. Both European countries require that the SEA system includes measures to prevent, reduce or at least offset the effects of the instrument. Chile does not have a similar regulation in the general SEA system, nor in the specific system for each planning instrument.

Although the reform that introduced SEA in Chile declared that its aim was to anticipate any associated adverse environmental effects or those that might result from the establishment of a certain policy or plan, and thus consider the prevention or mitigation of those effects or mechanisms to prevent the production

of cumulative environmental effects, which is mandatory in the case of urban spatial planning instruments, at the regulatory level, it has not reflected what exists in other experiences, such as those analysed in this work, where there is follow-up on the environmental effects of the respective instruments. While the regulations declare that they seek to incorporate sustainable development considerations into the spatial planning instruments, this is only done at a design stage, but not when the instrument has already been approved and is having an effect on the environment.

Another important aspect is related to the matters regulated by each of the instruments. According to the Chilean regulations associated with the instruments examined, the instruments have a scope associated exclusively with urban land use. Consequently, in their planning, they do not consider sectoral instruments, such as those related to energy, forestry, tourism, and indigenous peoples, among others. Despite the fact that when these urban planning instruments are subjected to SEA, they must consider "environmental and sustainability policies that could affect the spatial policy, plan or instrument that is to be implemented" (Article 14(b) of the SEA system's regulations), there is no rule that specifically determines which instruments or sectoral plans should be considered or what is meant by "environmental and sustainability policies" or which of these "could affect" the instrument being assessed, or how. This can be seen in Rozas-Vásquez et al. (2018), where communal regulatory plans do not consider international agreements or national environmental policies, or have a low frequency in the consideration of sectoral policies (40%). Although PROTs seek to develop a spatial planning that addresses sectoral areas, they are not yet in effect and their regulations establish that they cannot regulate matters with a scope of influence or operation that goes beyond the regional territory or areas that are subject to urban planning. In Portugal, however, there is coordination among the different planning levels (national, regional, sub-regional and municipal) and the integration of a wide range of sectoral policies (environment, transport, education, health, etc.) and citizen participation (Cavaco et al., 2020, pp.49-73). Interdependent relationships can be seen at all the levels studied, as stipulated in Decree Law No. 80-2015, which establishes coordination between public administration bodies as an imperative for action, with a view to national, regional, sub-regional and municipal development, committing to expeditious solutions to make spatial plans and programmes compatible with one another. This regulation is underpinned by Law No. 32, which includes in the definition of spatial planning: the preservation and protection of land with the potential to be used for agricultural, livestock or forestry activities, nature conservation, tourism and leisure, the production of renewable energy or the exploitation of geological resources (Article 37(d)); the adaptation of urban density levels, preventing the degradation of the quality of life (Article 37(e)); and the restoration and regeneration of degraded areas (Article 37(j)), mandating that land use programmes and plans be balanced in order to harmonise the different public interests with a spatial dimension, considering national defence, security, public health, civil protection and development strategies, as well as territorial sustainability, in economic, social, cultural and environmental aspects, in the medium and long term (Article 39). In the case of France, as indicated above, Article L-143-29 of the Urban Planning Code establishes the obligation to revise the Territorial Cohesion Plan when it anticipates changes to the guidelines defined by the planning and sustainable development project, and in turn the

lower levels of local urban plans must consider the territorial cohesion schemes (Article 131-2 of the Urban Planning Code); and with regard to the instruments that should be considered in the local urban plan: the general guidelines of policies for planning, public facilities, urbanism, landscape, protection of natural, agricultural and forest areas, and preservation or restoration, good state of ecological continuity; general guidelines for housing, transport and travel, energy networks, development of digital communications, commercial facilities, economic development and leisure activities, adopted for all public establishments involved in inter-municipal or municipal cooperation (Article 151-5). This coordination has been useful for compliance with measures associated with reducing greenhouse gases, identifying potential offsets and synergies between long-term emission strategies and other sectoral strategies (Aguilar, et al., 2020).

5. Conclusions

Although Chile introduced SEA in order to incorporate environmental aspects into the spatial planning instruments, the comparative exercise carried out in this study shows that there is a significant gap with regard to the regulations in France and Portugal. Considering the three criteria in the research questions, it is possible to question the effectiveness of Chile's decision to incorporate environmental variables into the spatial planning instruments, given that there are no follow-up measures, nor measures to adapt the instrument or offset its effects.

It can be concluded that the tasks of following up on or monitoring the environmental effects of the planning instruments in Chile are limited only to the "results of the plan", and thus the regulatory requirement of the SEA system is satisfied by establishing follow-up indicators of an urban nature. The difference compared to France and Portugal is substantial, considering that explicit reference is made to defining criteria, indicators and methods to assess the effects of the instrument at an early stage and thus react to unforeseen negative environmental impacts, as was indicated with respect to France; or measures to control the significant environmental effects in order to correct unforeseen negative effects, coupled with the possibility that the plan may be altered, revised or revoked, as in Portugal. Consequently, although the SEA system in Chile considers that planning instruments can declare environmental objectives and effects, this is not monitored during the implementation stage of the instrument, opening up a considerable gap between what is declared in the plan and what may or may not actually occur.

The differences can also be seen in the possibility that the instrument can be modified to reflect the evolution of the environmental variables, as Chile only includes a temporal update criterion (following a certain period of time), while France and Portugal not only include this criterion but also consider the way in which the environment reacts to the implementation of the plan. Accordingly, Chile's spatial planning instruments cannot be adapted and thus remain static over time, unable to evolve according to the environmental conditions that can be observed as time passes.

With regard to offset measures, they are considered in the instruments in France and Portugal, while there are no regulations stipulating this aspect in Chile. On a regulatory level, this demonstrates not only that the spatial planning instruments do not follow up on the environmental effects and are inflexible, but that they also do not have the capacity to react in a timely manner to the

unforeseen effects that they produce.

All of the above is exacerbated by the fact that the Chilean planning instruments are exclusively focused on what is defined as within the urban limits, without considering the definitions made in sectoral plans or programmes (energy, water, forestry, etc.), and are therefore limited both by a geographical aspect and by the matters they address, since there are no regulations related to coordination, as in the comparative experiences examined.

Given that Chile has declared in its national policy that it is necessary to measure and monitor urban environmental variables; and that despite the implementation of SEA in Chile, there are still gaps preventing the incorporation of environmental variables into the spatial planning instruments (OECD, 2016); and that an agreement was signed with the European Union to understand and implement its SEA best practices; and that, as noted above, it is important to establish a follow-up phase in order to ensure that the objectives of SEA are effective, it can be concluded that having identified substantial differences between the European follow-up models analysed and the Chilean model (such as the possibility of modifying the instrument as a result of environmental considerations and adopting offset measures), it is important to adapt the mechanisms of the SEA system in Chile, in order to equip the Chilean planning instruments with better possibilities for identifying and offsetting the adverse environmental effects they produce.

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Capítulo IV: Uso de Indicadores en la Evaluación Ambiental Estratégica de los Instrumentos de Planificación Urbana: Un Caso de Estudio.

En el presente capítulo se muestran los resultados de un segundo artículo científico, en estado *publicado,* en la revista ***Sustainability***.

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Article

USE OF INDICATORS IN STRATEGIC ENVIRONMENTAL ASSESSMENTS OF URBAN-PLANNING INSTRUMENTS: A CASE STUDY

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Abstract: The monitoring of the impact of cities on sustainable development initiatives has led several nations to adopt the use of the Strategic Environmental Assessment (SEA) instrument to enhance environmental management efforts. The use of indicators within this process is essential since they enable authorities to monitor and mitigate any adverse effects that may arise as a conse- quence of urbanization. Over a decade after the implementation of this instrument in Chile, a review of the indicators used in the SEA framework to monitor the impacts of urban planning has yet to be executed. Since there is no standardization of indicators under Chilean regulations, this study applied international classifications including the Pressure-State-Response indicator framework devised by the Organisation for Economic Co-operation and Development (OECD) in addition to the International Organization for Standardization (ISO) Standard 37120. Under these criteria, the environmental-monitoring indicators utilized in the most populous regions in Chile were

classified. Results show a limited use of indicators that can be categorized as related to urban-focused environ- mental monitoring. This paper concludes by posing certain questions that should be considered for future improvements to monitoring impacts generated by urbanization.

Keywords: environmental indicators; sustainability indicators; sustainable development; strategic environmental assessment; urban planning; land-use plan.

1. Introduction

Urbanization processes have led to a significant increase in the study of the sustain- ability of cities [1], to such an extent that the United Nations has established the objective to make cities and human settlements inclusive, safe, resilient, and sustainable as one of its Sustainable Development Goals [2]. Similarly, several measurement initiatives have been developed to monitor and compare the sustainability performance of cities around the world.

These urbanization processes have been implemented by means of distinct instruments such as plans, policies, or programs devised by the authorities of each nation. Indeed, countries have gradually incorporated sustainability objectives into national legislation over time in an effort to recognize the interactions between the different uses of land and their effects on the environment. This has traditionally been carried out via Environmental Impact Assessment or, in recent decades, Strategic Environmental Assessment [3–6]. Strategic Environmental Assessment (SEA) aims to ensure that sustainability considerations are taken into account during strategic decision-making processes [7], including those related to urban planning.

SEA has been incorporated by different nations using distinct approaches [8], in order to improve the evaluation of environmental and sustainability implications of national plans, policies, and programs. To fully meet the subsequent objectives, it is essential that all consequences of the decisions taken are crosschecked against the perceived effects and, in the process, ensure that impacts are minimized [9]. Accordingly, the SEA framework could directly contribute to the achievement of its stated objectives if it were to incorporate a monitoring model to evaluate whether the stated objectives have been achieved. It would also allow for the publication of the results of the executed processes [10] and help facilitate the corresponding changes required.

Under the SEA monitoring model, indicators are considered an essential component for the implementation of the sustainability concept [11]. This is because they facilitate the assessment of current conditions, the monitoring of trends in certain conditions over a period of time, and the anticipation of hazardous conditions that may arise in the future [12]. Overall, indicators are recognized as fulfilling a critical role. For example, they provide information about the progress of proposed sustainability objectives, such as in the case of the resource Key Environmental Indicators for Ireland [13], and prove highly useful in influencing public opinion and authorities to call for and adopt the most appropriate measures [14] with regards to fulfilling relevant objectives.

However, the way indicators are incorporated into the SEA framework will affect their performance. Chile incorporated the SEA system in 2010 and established that all national land-use- and spatial-planning instruments must be

subject to the assessment framework as part of the broader evaluation process [15]. The objectives were multiple: to incorporate environmental considerations of sustainable development into the design and implementation of general regulatory plans, policies, and programs that impact on the environment or sustainability processes; to ensure the integration of such considerations within the respective plan, policy or program including any subsequent amendments or modifications thereto; and to detect any potentially adverse environmental effects associated with, or that may result from, a particular plan, policy, or program, and thus facilitate the mitigation of such effects in order to prevent subsequent and/or cumulative environmental impacts [16].

Internationally, since the 1960s and 1970s, environmental impact assessment has been utilized to incorporate the environmental variable into the decision-making process of certain policies, plans, program, and, in particular, investment activities or projects [3–6]. The limitations of EIA, as recognized [17,18], led to SEA, considered to be the appropriate route for identifying—in a formalized assessment process, at an early stage—the environmental impacts of decisions made at a policy, plan, and program level [4], and a tool that makes it possible to link the degradation of nature with the sustainable development objectives of poverty reduction [19], as well as recognizing its influence on the choice between development alternatives during the early phases of decision-making. In other words, SEA can facilitate a proactive approach in order to ensure that environmental and sustainability considerations are taken into account during the initial phases of a strategic decision-making process [7]. Prior to the incorporation of the SEA framework, planning instruments were evaluated under the Sistema de Evaluación de Impacto Ambiental (Environmental Impact Assessment System). Under this system, official reports argued that land-use and spatial-planning instruments failed to prevent environmental pressures caused by changes to the way in which land was utilized. Problems that were frequently highlighted included uncontrolled urban sprawl and the construction of factories in environmentally sensitive areas or locations vulnerable to natural disasters. Consequently, authorities proposed the incorporation of the SEA instrument [20].

At present, land-use- and spatial-planning instruments in Chile that establish regulations applicable to the use of land are restricted almost exclusively to the urban context. In addition, their legal objective is to guide and regulate the development of urban areas ac- cording to a national, regional, and municipal-level policy of socio-economic development. Urban planning is executed at three levels: national, inter-municipal, and municipal, with the latter two being obligatory. Chilean legislation stipulates that urban planning at the municipal level should promote the harmonious development of the local area, particularly of the most populous districts, in accordance with the regional goals of economic and social development. Municipal-level urban planning is executed by means of the Plan Regulador Comunal (Municipal Regulatory Plan), or PRC (by its Spanish acronym).

As per Chilean regulations, both the PRCs and their substantial modifications must be submitted to SEA in order to ensure the incorporation of sustainable development considerations, i.e., environmental objectives and impacts and sustainable development criteria. As determined by Decreto Supremo (Supreme Decree) 32 issued by the Ministry of Environment (MMA), the administrative procedure that concludes the SEA process must identify the

monitoring indicators required to regulate its effectiveness. This refers to the elements of analysis required to understand and evaluate the potential outcomes of the implementation of an urban plan submitted to SEA for approval. In addition, the MMA devised a guideline which recommended that all indicators to monitor the effectiveness of the plan should also stipulate the fulfilment of the proposed environmental objectives outlined therein [21]. The guideline stated that the purpose of environmental monitoring of land-use- and spatial-planning instruments is to establish the extent to which the environmental objectives formulated in the SEA procedure are met [21]. In 2015, the MMA published a new guideline for the use of SEA in which it stated that indicators should be quantitative or qualitative, and not descriptive but indicative. This guideline also established criteria for the development of indicators in line with recently published research on the subject [22]. In the same year, a further guideline for incorporating an environmental dimension within sustainable land-use- and spatial-planning processes was published, which comprises a list of recommended indicators [23]. The aforementioned outlines the set of conditions devised by authorities for the design and development of indicators, in which only one is mandatory for the authorities responsible for overseeing the process (that established by Supreme Decree 32).

Over a decade after the implementation of the SEA instrument in Chile, now is an opportune moment to review the indicators used for municipal-level urban planning under the SEA framework. This review will help to identify the most important lessons learned and devise best practice moving forward for future indicator-based assessments. With that in mind, this study sought to evaluate two main aspects. First, whether the authorities mandated to implement the SEA of PRCs are fulfilling their responsibilities to include indicators and, simultaneously, monitor environmental conditions that may be affected by the Plans in order to anticipate potentially adverse environmental impacts generated. Second, to identify the particular aspects of sustainable development on which the indicators used by PRCs during SEA focus.

It should be noted that there is an absence of a standardized set of indicators within the Chilean SEA framework. To conduct this study, it was therefore necessary to follow ob- jective criteria devised by relevant third-party classification instruments to assess whether SEA has successfully contributed to the incorporation of environmental considerations of sustainable development in land-use- and spatial-planning instruments. Consequently, two classifications of indicators used at the international level to measure sustainability in cities were applied. The first was the Pressure–State–Response (PSR) model utilized by the Organisation for Economic Co-operation and Development (OECD). The PSR model distinguishes between sets of indicators of environmental pressures (direct and indirect), environmental condition (state), and society-wide response [24]. This framework was adopted by OECD countries in the 1970s and member states continue to view it as a robust and useful model since it has provided continuity to the development of distinct sets of environmental indicators since its inception [25]. The PSR indicators can be used to evaluate the pressures of human activities on the state of the environment and provide policy responses to achieve a so-called “desirable state”. This approach has recently been extended to social, institutional, and economic dimensions [26]. It also has the advantage of being one of the most straightforward frameworks to understand and put into practice, as well as being neutral in the sense that it defines what linkages exist, rather

than whether these have positive or negative impacts. Depending on the purpose for which the PSR model is used, it can be easily adjusted to take account of greater detail or specific characteristics. It should also be noted that Chile places great importance on being a member nation of the OECD and it should therefore consider this latter model as a point of reference for developing sustainability and/or environmental indicators moving forward.

According to Ji [27], the OECD PSR classification is one of the most famous worldwide, in particular its conceptual framework that has in turn influenced similar activities in several countries and international organizations (United Nations Commission for Sustainable Development (UNCSD), the United Nations Environment Program (UNEP), the World Bank, the European Union (Commission of the European Communities, Eurostat, the European Agency for the European Environment Agency) and with a number of international institutes including non-OECD countries [28]. The PSR classification model can be used to determine whether the indicators applied in the Chilean SEA of PRCs relate more to pressure, state, or response. To clarify, indicators that relate to pressure focus on aspects that PRCs seek to modify (a current pressure that is exerted and which PRCs seek to alter). Those that relate to state assume a role of monitoring the current state of (environmental) conditions at the time of PRC adoption or modification. Those that relate to response aim to understand whether the effects sought by PRCs have been established.

The second classification system used by this study corresponds to International Standard 37120 emitted by the International Organization for Standardization (ISO), called 'Sustainable development of communities— Indicators for city services and quality of life'. The Standard used in this study relates to its first edition that was published in 2014, also known as ISO Standard 37120:2014. It is the first international standard for indicators on cities [29] and its origins go back to a research project financed by the World Bank on development indicators for Latin American cities. It currently has empirical applications [30,31]. In addition, it has allowed a global registry of data reported by different cities in the world that have applied the standard [32].

This Standard developed a set of 100 indicators for 17 sectors or areas (see Table 1) including urban planning, environment, energy, solid waste, wastewater, and transport, among others. The Standard establishes a selected set of indicators that provide precise definitions to facilitate the measurement of city performance across a range of indicators [33]. As such, it is considered a serious attempt to compare and contrast cities [30]. ISO developed the Standard in order to provide clear recommendations on what and how to measure. The main objective of the model itself is to assist city authorities to measure the performance management of their municipal services and the quality of life of their residents over time. This includes facilitating learning from one city to the next, enabling comparisons to be made across a wide range of measurements, and for the sharing of best practice in general [34].

By means of this classification, the present study sought to determine whether the indicators used in the Chilean SEA can be adjusted to any of the 100 indicators proposed by the aforementioned ISO Standard 37120. Such an approach would help to identify whether the authorities mandated to implement SEA of PRCs focus on any of the 17 areas of sustainable development established by the Standard.

The primary aim of this study was to learn lessons about current practices

in the use of applied indicators at municipal-level regulatory plans submitted to SEA in Chile. The objective also included identifying whether the authorities responsible were monitoring the state of the environment during plan implementation, which would thus enable them to prevent adverse environmental outcomes, in addition to evaluating which areas of sustainable development were being considered in those indicators applied.

Table 1. Areas of the ISO Standard 37120:2014.

No.	AREA
1	Economy
2	Education
3	Energy
4	Environment
5	Finance
6	Fire and emergency response
7	Governance
8	Health
9	Recreation
10	Safety
11	Shelter
12	Solid waste
13	Telecommunication and innovation
14	Transportation
15	Urban planning
16	Wastewater
17	Water and sanitation

2. Materials and Methods

This study compiled a set of indicators to monitor the effectiveness of the plan de- ployed via the framework of the SEA of the PRCs. In order to understand which land- use- and spatial-planning instruments have been subjected to SEA, the MMA maintains an updated register which can be accessed in different formats on its official website: eae.mma.gob.cl

As part of the study, an MS Excel spreadsheet was downloaded (see File S1 in Sup- plementary Materials) which provides a full register of the instruments submitted to SEA, including district-based policies and zoning plans, inter-municipal regulatory plans or PRCs, and others at distinct stages of the SEA process. The register contains informa- tion pertaining to 411 instruments submitted to SEA from when the system entered into force in 2010 until 1 March 2021 (the date on which the latest version of the register was downloaded).

By means of the first filter process, of the 411 instruments submitted to SEA, 291 relate to PRCs, i.e., 71%. A breakdown of the register is provided in Figure 1.

A second filter was then executed, which yielded the following results: of the total number of PRC instruments, only those that had successfully overcome two of the key procedural stages were considered. These two stages are the resolution of termination and resolution of approval of the instrument. The resolution of termination is issued by the authority responsible for the PRC (this generally relates to the respective municipality). The role of this authority is to finalize the SEA approval stage of the PRC, including emphasizing that all stages and requirements for such assessment have been fulfilled [35]. The resolution of approval is issued by the respective authority responsible and its role is to ensure that, by means of the resolution, the PRC is deemed to be in force. Therefore, the difference between the two procedural stages is that the resolution of termination declares that the SEA of the PRC process has been concluded, while the resolution of approval of the instrument stipulates that the PRC itself has been approved. Consequently, once the instrument has completed these steps, one of which is the SEA process itself, it has thus fulfilled all procedural stages necessary to enter into force. Since both procedural stages apply to the indicators, in the event that one was not identified by the resolution of approval, the resolution of termination was reviewed. These particular procedural stages were selected because they emphasize how the SEA of PRCs is not subject to any subsequent modifications with respect to the indicators used, since no further revision or observation stages remain.

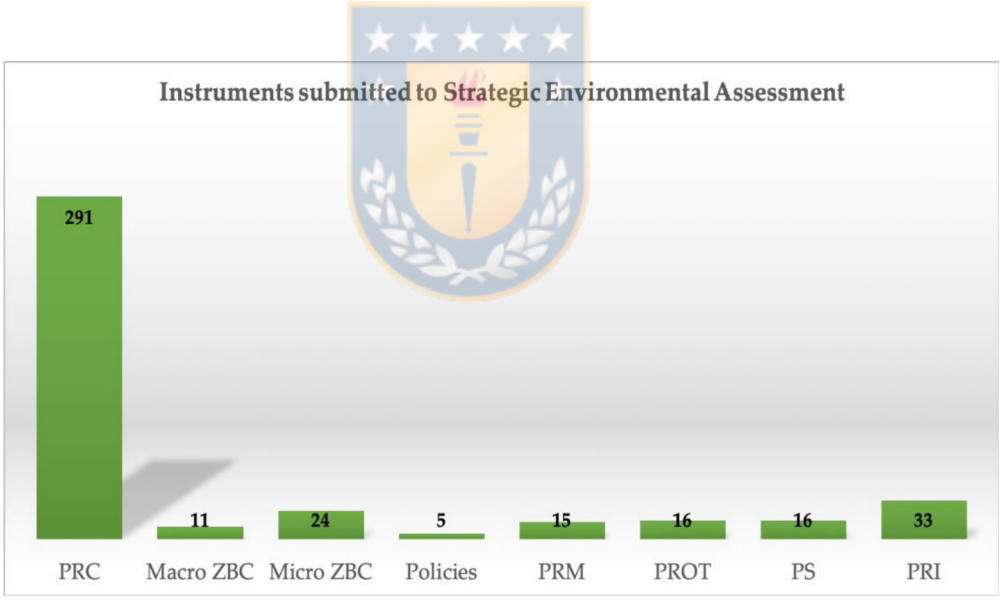


Figure 1. Total number of eligible instruments submitted to SEA

PRC: Municipal Regulatory Plan; Macro ZBC: Coastal Boundary Macro-zoning; Micro ZBC: Coastal Boundary Micro-zoning; PRM: Metropolitan Regulatory Plan; PROT: Regional Land-use Plan; PS: District Plan; PRI: Inter-municipal Regulatory Plan. Findings based on in-house research.

The application of this second filter shows that out of the total number of PRCs submitted to SEA (291), 100 had reached the resolution of termination and resolution of approval stages in relation to the period studied (Figure 2).

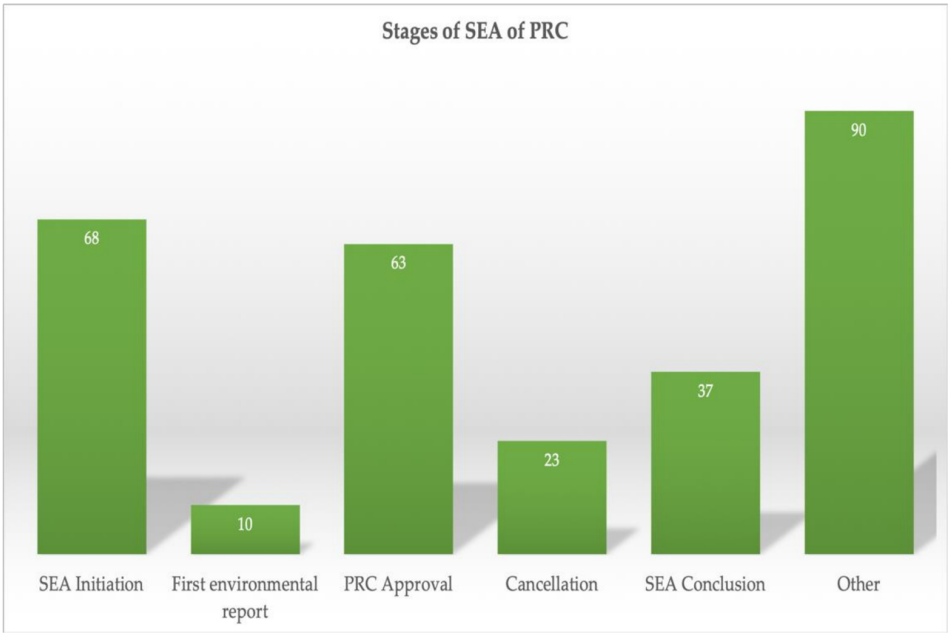


Figure 2. Latest procedural stages of PRCs subject to SEA. Findings based on in-house research.

The population of Chile is primarily concentrated in the Metropolitan, Valparaiso, and Biobio regions (see Figure 3 and Table 2) [36]. Furthermore, the high concentration of urban centers in these regions is located geographically in and around an area defined as having a Mediterranean climate (Figure 4). This area is recognized as a biodiversity hotspot for both the endemic nature of its flora and fauna and the threat to their collective conservation [37]. Accordingly, only the PRCs issued in these three regions have been considered for this study, and this geographical selection represents the third filter of this research. The Mediterranean climate in this area of Chile is extremely fragile and, therefore, urbanization can cause severe and critical impacts on the local environment due to the existence of high levels of pollution, soil sealing, increased runoff and other associated risks [38].

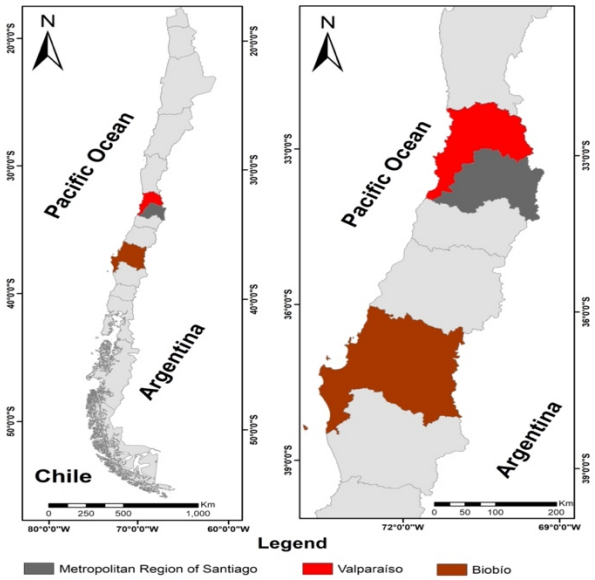


Figure 3. Study area.

REGION	POPULATION	AS APERCENTAGE OF NATIONAL TOTAL
Arica & Parinacota	226,068	1,3%
Tarapacá	330,.568	1.,9%
Antofagasta	607,.534	3.,5%
Atacama	286,.168	1.,6%
Coquimbo	757,.586	4.,3%
Valparaiso	1,.815,.902	10.,3%
Metropolitana	7,.112,.808	40.,5%
O'Higgins	914,.555	5.,2%
Maule	1,.044,.950	5.,9%
Biobio	2,.037,.414	11.,6%
Araucanía	957,.224	5.,5%
Los Rios	384,.837	2.,2%
Los Lagos	828,.708	4.,7%
Aysen	103,.158	0.,6%
Magallanes	166,.533	0.,9%
Total	**17,.574,.003**	**100.,0%**

Table 2: 2017 Census results 2017.

Source: Statistics National Institute of Statistics, Chile.

By applying this third filter, a total of 51 PRCs were identified in the aforementioned stages in relation to the three most populous regions in the country (Figure 5).

Subsequent to the selection of the three aforementioned regions, the resolutions of terms and the resolutions of approval of each PRC were reviewed in order to identify the environmental-monitoring indicators used in the SEA framework, a legal requirement for the approval of the respective PRC. Having

identified the indicators, each one was subject to the classification process. This was executed by selecting each indicator in turn and contrasting it with the PSR-based criteria from the OECD and the indicators pertaining to ISO Standard 37120.

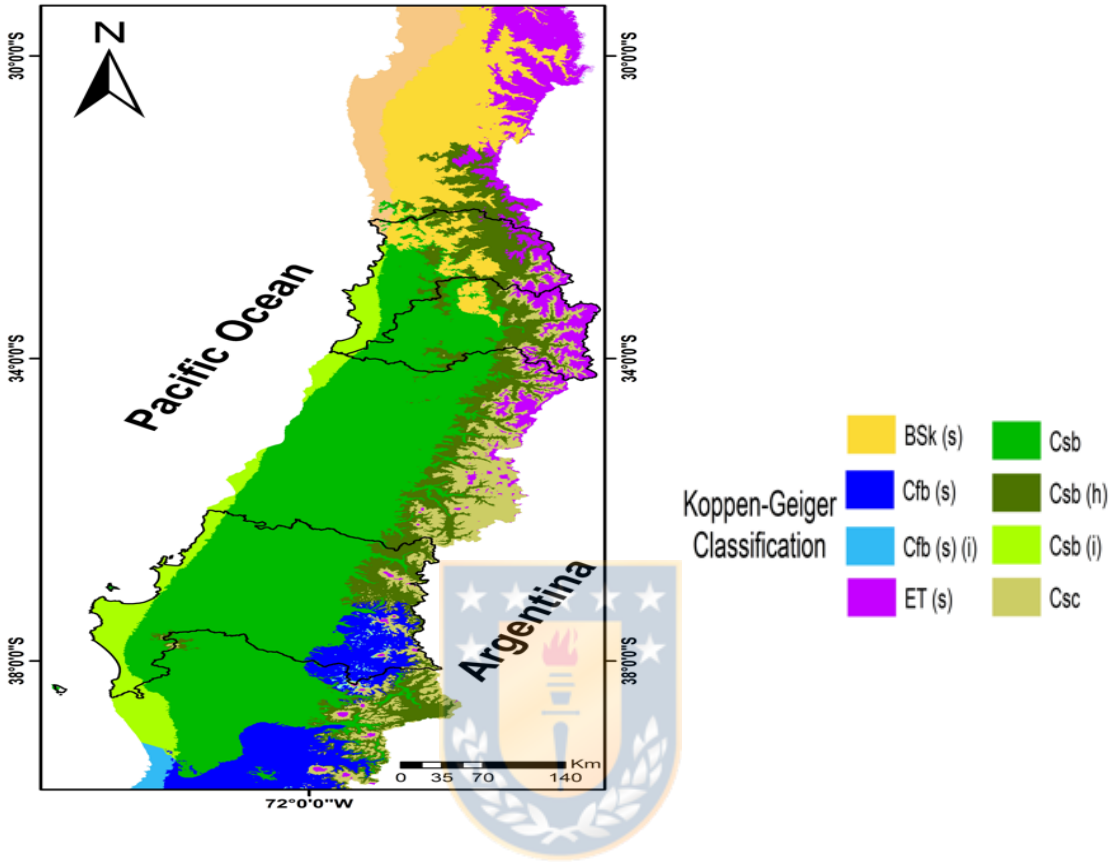


Figure 4. Mediterranean climates in Chile as defined by the Köppen–Geiger climate classification system:

BSK(s): Semi-arid climate with wet winters; Cfb(s): Temperate wet climate with slightly dry summers; Cfb(s) (i): Temperate wet climate with slightly dry summers and coastal influence; ET(s): Tundra climate with wet winters; Csb: Mediterranean climate with wet winters; Csb(h): Mediterranean climate with wet winters at high altitude; Csb(i): Mediterranean climate with wet winters and costal influence; Csc: Cold Mediterranean climate with wet winters.

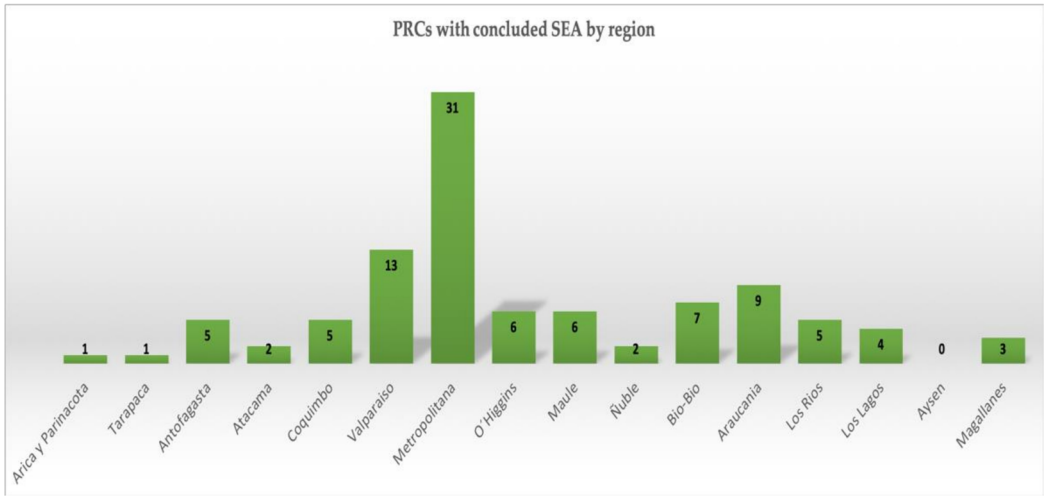


Figure 5. Number of PRCs subject to SEA to have undergone all procedural stages studied, by region. Findings based on in-house research.

3. Results

A total of 300 environmental-monitoring indicators were obtained from the 51 PCRs related to the three regions analyzed in this study. Each individual indicator was noted down in line with the submissions made by the relevant authority responsible during the SEA process (See File S2 in Supplementary Materials).

It should be noted that the results show a high dispersion of indicators. This reflects the fact that each authority is responsible for establishing its own indicators.

3.1. Classification by OECD-PSR Model

The framework proposed by the OECD classification bases its indicator typology on what is being observed by that indicator. A pressure indicator seeks to answer the question “why is something happening?”, i.e., to assess the range of pressures or actions exerted by human activities A state indicator is designed to answer the question “what is currently happening in the environment?” and thus seeks to record trends in the biological or physical conditions of the natural world. A response indicator collects information associated with the actions taken to bring about the expected change, and therefore seeks to answer the questions “what will be done to bring about change?” or “what has been done to bring about a certain outcome?”

The review of the 300 indicators was conducted individually by each author of this study, through a qualitative analysis of the indicators collected by applying the conceptual tools that the PSR and ISO classification has elaborated (Figure 6). In cases of disagreement, the final results were agreed on by consensus. Qualitative data analysis was used in cases with a large amount of data obtained from practical experiences (such as the 300 indicators used by the Municipalities in PRC) [39], since it allows interpretations and conclusions. Due to dispersion of indicators, this qualitative analysis had the following stages: first, recompilation of the database (review PRCs submitted to SEA); second, transcription of data (File S2); third, codification of data trough conceptual tools made by the OECD and ISO; and finally, classifying registered indicators according to those international categories [40].

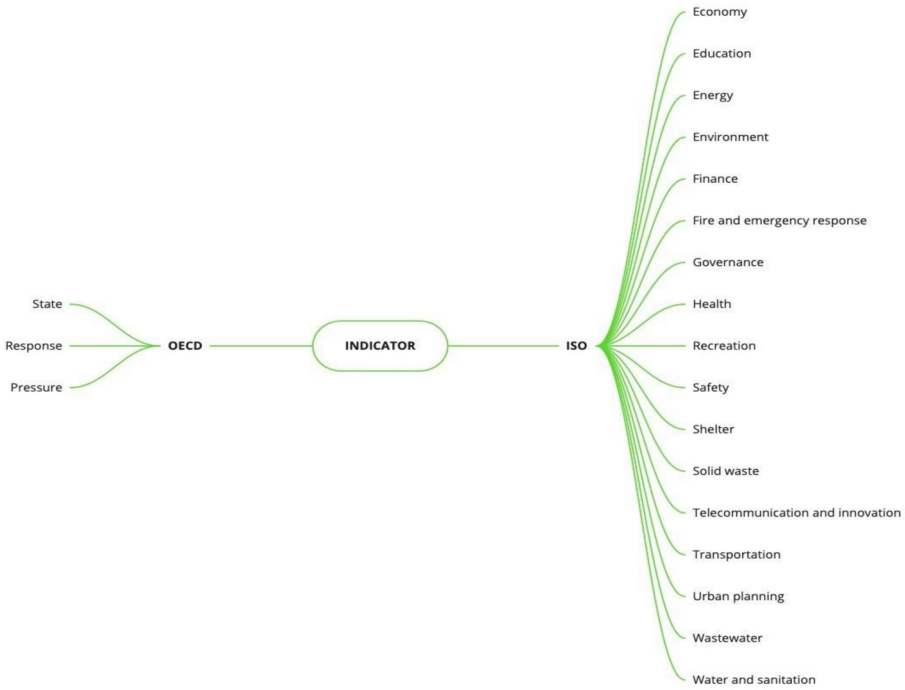
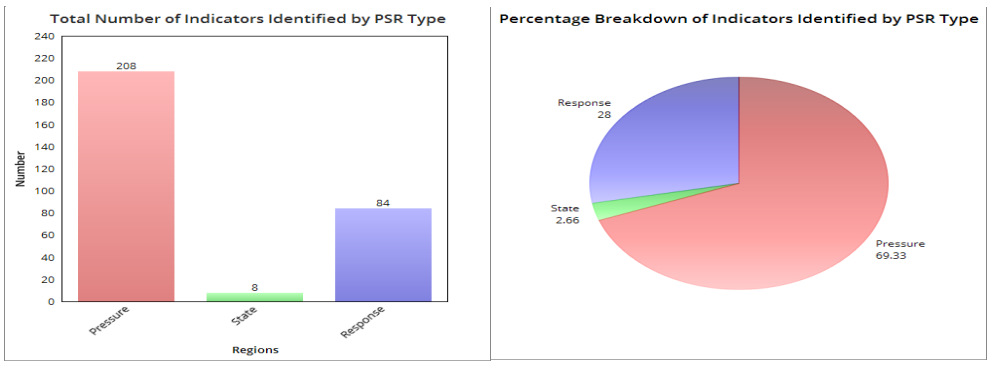


Figure 6. Classification of indicators by applying conceptual tools of PSR and ISO.

The review shows (see File S3 in Supplementary Materials) that over 69% of the 300 indicators used in the study area focus on the pressure-type indicator (see Figure 7), i.e., the different forms of pressure or action that will be generated by the PRC. Consequently, the indicator used focuses on the type and/or extent of that pressure. For example, the indicators identified in this regard include those related to: equipment and public-area projects implemented in municipal parks; decreasing the housing deficit; increasing basic and intermediate-level housing in the local area; percentage of building permits for certain areas of interest to the PRC; percentage of expropriated or consolidated roads affected by a declaration of public utility; and surface area (in square meters) of green and recreational spaces developed in the earmarked areas, among others.

Figure 7. (a) Total number of indicators identified by PSR Type; (b) Percentage breakdown of indicator identified by PSR Type. Findings based on in-house research.



A smaller number of response indicators were identified, representing 28%

of the total. These indicators focus on actions due to be implemented via the PRC, including: restrictions to new lakefront developments and the commissioning of protected coastal zones to ensure the environmental recovery of lakes; commissioning of land areas that constitute the system of green spaces; public spaces and municipal parks; construction of housing projects; selective waste collection; use of areas of natural value for research purposes; construction of bicycle lanes; use of adjacent green spaces; consolidation of areas for recreational and public use; and the definition of waste-management plans for disused sites, among others.

As previously noted, the state indicators aim to record trends in the biological or physical conditions of the natural world. Overall, eight such indicators were identified, representing 2.66% of the total. These include indicators related to the following: greater rainwater infiltration capacity according to land use; measurements of air pollutants and compliance with air-quality standards regulations in cities; air quality measured by particulate matter and emissions from mobile sources; existing infiltration surface in square meters (greenfield sites and brownfield sites) assessed periodically; number of floods in the municipal area from significant rainfall events; and prevalence of floods in the local area, among others.

3.2. Classification by ISO 37120

Due to their high dispersion, the indicators identified in this study do not strictly comply with those outlined in the ISO Standard. Furthermore, since ISO 37120 pertains to a worldwide standardization of indicators, it was necessary to study each one in turn and subsequently assimilate them with the indicators used in this research. Consequently, each of the indicators used in the sample studied was analyzed prior to undergoing its respective categorization according to one of the sustainable development areas contained in the ISO Standard.

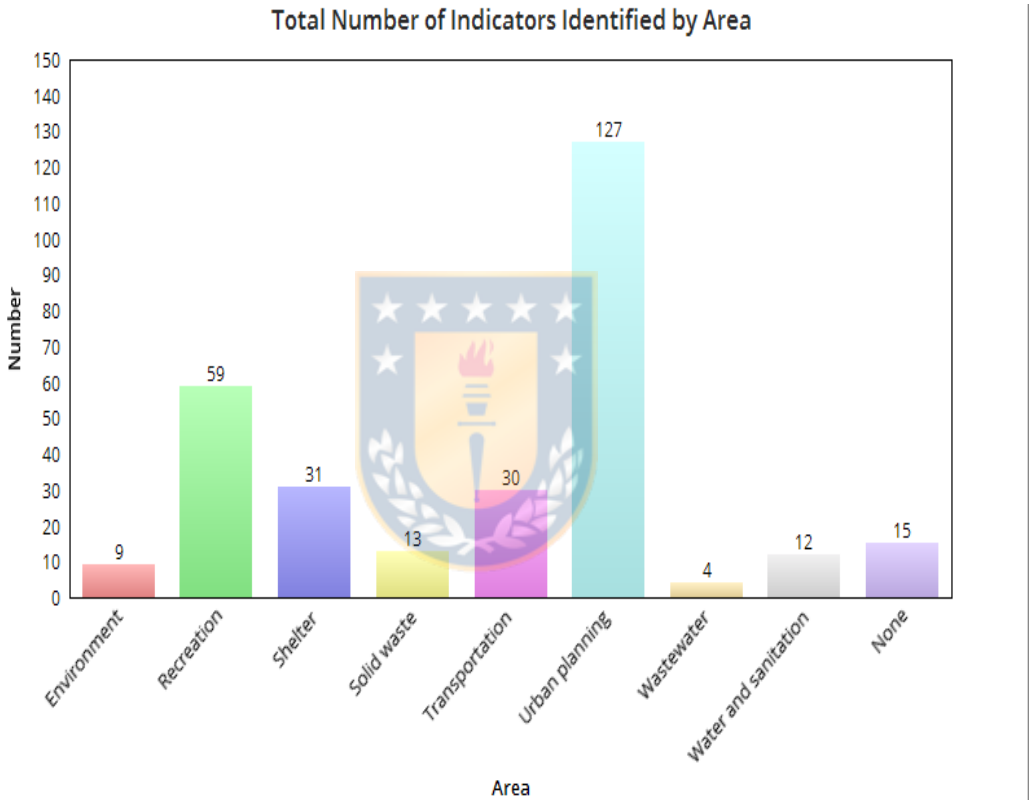
Of the 17 sustainable development areas that comprise the ISO Standard, nine did not contain assimilated indicators, including Economy, Education, Energy, Finance, Fire and emergency response, Governance, Health, Safety, and Telecommunication and innovation. This may be due to the fact that Chilean regulations do not grant powers to PRCs in the aforementioned areas.

Of the eight areas in which indicators similar to the 300 used in the study area were identified (see File S4 in Supplementary Materials), those related to Urban planning represented 42% of the total, with 127 indicators (Figure 8). The other 58% were distributed among the remaining areas. There were also 15 types that could not be classified under any of the indicators according to the ISO 37120 criteria and which were marked ‘None’.

In relation to the ISO indicators that pertain to the area of Urban planning, the most recurrent ones identified in this study concern urban issues that PRCs seeks to prevent or implement, including irregular building ownership and the regularization of unplanned developments or unauthorized housing that fails to comply with local building codes and regulations, as described in the ISO Standard. For example: percentage of buildings repaired or restored in conservation areas of historic interest; percentage of consolidation of the use of residential, commercial, and service developments in areas of special interest to the authority responsible; number of disused and green sites; and their conservation status located within urban boundaries; devise a localized plan for the civic neighborhood which adjoins main squares (Plazas de Armas) in order

to conserve nearby culturally significant buildings and encourage urban development that is harmonious with these historic sites; and enter into agreements with large companies located in predominantly residential districts in urban areas to facilitate their relocation to industrial areas.

The sustainable development area as classified by ISO Standard 37120 that produced the second-most indicators was Recreation, which refers to green spaces destined for distinct uses as outlined by each PRC in question. Common uses include: percentage of surface area (in hectares) of green spaces developed in relation to the total surface area of green spaces (ZAV) and communal parks (ZPC); surface area (in square meters) of green spaces and recreation zones developed in ZAV areas; control of access to ecologically protected areas from urban areas; and use of adjacent green spaces, among others.



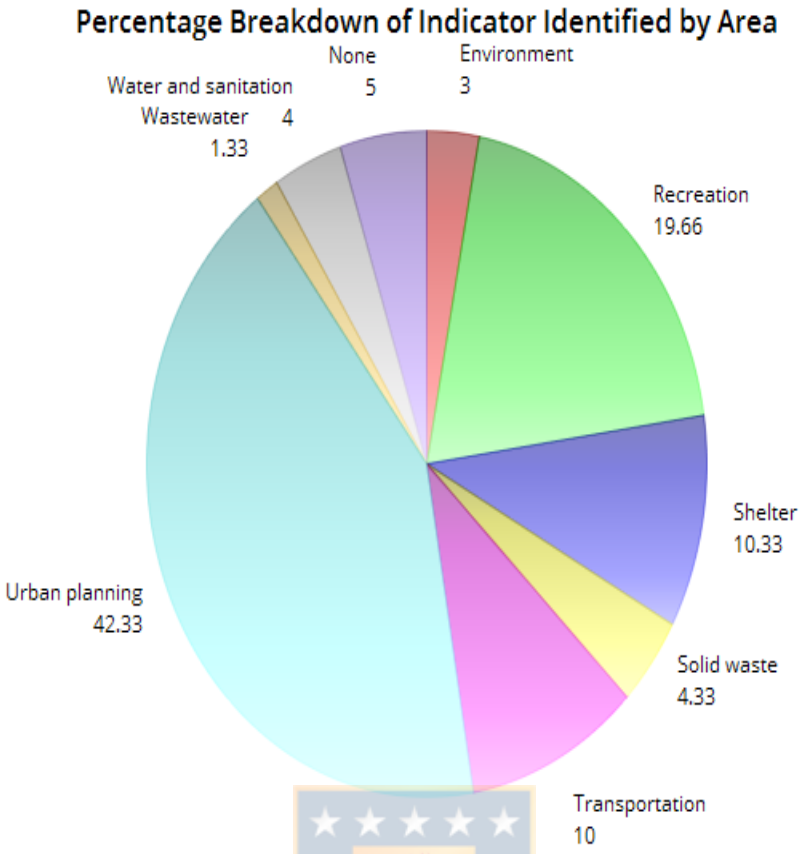


Figure 8. (a) Total number of indicators identified by Area; (b) Percentage breakdown of indicator identified by Area. Findings based on in-house research.

4. Discussion

By following the OECD criteria, findings show that pressure indicators constitute a large percentage of the indicators used across the study area. This means that PRCs undergoing SEA concentrate primarily on the collection of information to describe what kind of pressure and/or the extent of that pressure that the respective instrument will generate. It was common practice for the authors to identify indicators related to the granting of building permits or the number of expected constructions, but not what the impact of such constructions would be on sustainable or environmental development. Conversely, only a small percentage (3%) of the results incorporate state indicators, which would enable the authorities responsible to assess the current state of the environment or the state thereof during the execution of the PRC in question.

The indicator review conducted by following the ISO Standard 37120 criteria confirms the findings generated by the OECD-indicator analysis. It shows that from among the 17 areas described by the Standard, the indicators used in Chile focus primarily on urban and recreational aspects (essentially, indicators associated with green spaces). In conjunc- tion, the two areas of Urban planning and Recreation account for over 60% of all indicators identified, while only 3% pertain to the Environment category.

The results show that the authorities responsible are generating very limited informa- tion on the environmental impacts of their PRCs. Although SEA regulation in Chile aims to incorporate environmental considerations of

sustainable development into the design and implementation of general regulatory plans, policies, and programs that have an impact on the environment or sustainability, this practice is not reflected among the indicators being applied. Rather, these indicators focus more on recording the urban-based outcomes of the Plan than the environmental impact or the impact on sustainable development. In theoretical terms, the measurement of sustainability in cities can focus on measuring the quality of urban systems and the impact that cities have on the environment [41]. In law terms, the European Union incorporates SEA and the corresponding follow-up in Article 10 of Directive 2001/42/EC—the SEA Directive (2001)—it nonetheless grants a significant degree of flexibility to each member country to establish rules specific to their reality [42]. In File S1, there is a description of the measures envisaged for "monitoring" the effects of the plans and programs, in order to, inter alia, promptly identify unforeseen adverse effects and allow appropriate remedial action to be undertaken. File S1(g) identifies, among the information to be provided, the measures envisaged to prevent, reduce, and, as fully as possible, offset any significant adverse effect on the environment resulting from the implementation of the plan or program. Empirically, Shane and Graedel [43] have pro- posed "metrics" such as: average annual atmospheric concentration of O3 at soil level, SO2 emissions per capita, water use per capita, a measure of water used with the sustainable draw from an area's watershed(s), measures of water quality including bacterial growth, turbidity, acidity, nutrient concentrations, and concentrations of toxins; and about the waste issues: trips to a disposal site, recycling center, or incinerator. The ISO Standard 37120 proposes different indicators such as percentage change in number of native species, noise pollution, NO2 concentration, greenhouse gas emissions measured in tonnes per capita, percentage of population with authorized electrical service, among others. Furthermore, the OECD has developed indicators [44] such as emissions of nitrogen and phosphor in water and soil, biological oxygen demand in inland waters, emissions of heavy metals, emissions of organic compounds, intensity of use of water resources or forest resources, habitat alteration, and land conversion.

It is possible to explain these results from a regulatory point of view. SEA regulation in Chile states that monitoring criteria and indicators should be identified in order to oversee their effectiveness. In addition, it asserts that monitoring criteria are understood as the set of elements of analysis aimed at enhancing the knowledge and evaluation of the outcomes of the implementation of a plan, policy, program or land-use- and spatial-planning instru- ment subject to SEA within a given timeframe. However, since regulations fail to provide definitions of what "oversee the effectiveness" and "outcomes of implementation" of the PRC mean in practice, the authorities responsible have been able to fulfil requirements necessary to secure SEA approval of PRCs by focusing on aspects other than those per- taining to environmental or sustainable development factors. As the results demonstrate, the recommendations provided by the guidelines cited in Section 1 of this study have also been insufficient, despite having helped to broaden the scope of the use of indicators to assess fulfilment of proposed environmental objectives. A further explanation of the results relates to the way in which PRCs are able to regulate on primarily urban matters [45] and which therefore have no regulatory mandate to establish standards in other areas of sustainable development in cities, as is proposed by the ISO Standard. Consequently, the regulations themselves limit the possibility to follow up on

environmental considerations of sustainable development that are stipulated as an objective by existing SEA regulation. Previous work on this topic has concluded that ecosystem services (ES) are consid- ered in all SEA reports to have undergone analysis (15 reports including regional, inter- municipal, and PRC instruments) and that ES are also included in monitoring stages [46]. However, it proved necessary to examine the events of the final stages of SEA and those focused on PRC in this study. This is because these events relate to the most frequently applied land-use- and spatial-planning instruments in Chile from an urban point of view (as observed in Figure 1). Specifically, the aforementioned instruments are designed to determine whether differences exist between the objectives drawn up and what becomes of the indicators that are due to be applied during PRC implementation, as well as the extent of these differences, if relevant. Accordingly, this work contemplated a sample of 51 PRCs from the most populous regions of Chile using the main indicators for each instrument.

In 2016, the OECD reported on the lack of evidence as to whether SEA has resulted in significant modifications to land-use and spatial development plans in Chile as part of efforts to enhance the mitigation of environmental problems in urban areas [47]. It should be noted that the challenge of rectifying this problem warrants more than simple regulatory amendment. Indeed, previous studies show that the monitoring stage is limited to the development of impact monitoring or supervision reports (requirements that are not accounted for in Chilean regulations) and that in certain nations where SEA is not legally recognized, monitoring nevertheless is conducted in areas such as governance, planning, and management [48].

Furthermore, the use of indicators requires meticulous selection. It is not sufficient to simply adopt a set of indicators (such as one of the two examined in this study) as a standard that can subsequently be applied to all instruments under assessment. This is because problems can arise due to the limitation of certain environmental indicators that measure only a restricted number of parameters or which have a different sensitivity to the aspect undergoing monitoring due to the speed at which environmental changes take place [49]. In other cases, excessive amounts of detailed information are unnecessary since they may cause confusion for the decision-maker or provide a false impression of accuracy [50]. To ensure the adoption of the most adequate indicators, the best practice is to follow the criteria recommended by experts in the field rather than simply applying a pre-established set. The work undertaken by Donnelly et al. [24] or Button [51] provides a valuable starting point in this regard.

As we have empirically analyzed the performance of SEA, especially regarding the type of monitoring indicators used by municipalities (which is the local government of Chile), it can become a useful way for other nations (Peru, Argentina, Costa Rica, and the European Union with Portugal, France, Spain, European Union, Slovenia, and others [8–52] that have adopted normative designs of this instrument in a similar way to the one that was promulgated in Chile to study the operation of their own strategic environmental assessments. In addition, international organizations such as the OECD have published where they account for the scant evidence on the operation of SEA [47], so this work may draw attention to its effectiveness in incorporating environmental variables into territorial-planning instruments.

This study generates a number of questions for future work on the topic,

including: what happens to the information that is generated by the indicators used in the SEA of the PRCs? Is this information taken into account in future PRC reforms? How can the lessons learned from the application of indicators of a municipal PRC be used to design subsequent PRCs in the same municipality? In this regard, regulations in Chile do not provide additional details and therefore, further doubts remain about the real contribution of SEA.

5. Conclusions

Effects of cities on the environment are a matter of current global concern, so under- standing their consequences is a task of special relevance, where Strategic Environmental Assessment is an instrument that has been selected to evaluate these effects. Better SEA will depend, among other factors, on the way it affects the plans that cities design. In this sense, the indicators are a key piece to evaluate the consequences of the implementation of plans and policies, since they help to facilitate comparisons within the same city and between cities.

The SEA regulatory model followed in Chile shows a dispersion of indicators and focuses primarily on urban aspects, thereby fulfilling the regulatory requirement to monitor the “effectiveness of the plan”. The authorities responsible for the execution of SEAs and those interested in achieving PRC approval comply with existing legal requirements by simply monitoring facts. The results show that the indicators defined by the responsible authorities do not focus on monitoring the environmental effects of the PRC, making it less likely that they will make informed decisions to adjust the plan to the unforeseen environmental effects that it generates or compensate for them. Examples of this prac- tice include expansions to road infrastructure that do not consider resultant greenhouse gas emissions, or indicators on granting of building permits or the number of expected constructions but not what the impact of such constructions would be on sustainable or environmental development, i.e., they fail to monitor the environmental impacts or the effects on sustainable development of the urban-planning decisions adopted. Even though PRC does not have power in certain sustainable development areas, the objective of SEA is ensuring the incorporation of sustainable development considerations to land-use planning instruments such as PRC, so this empirical analysis (made on a representative sample of used indicators in PRC on the most populated regions in Chile) demonstrates a need for amendments to SEA regulation, requiring indicators that allow a follow-up of environmental impacts.

The results may be useful for other countries that have followed SEA models, since according to our bibliographic review, an empirical analysis of the use of indicators in urban plans has not been carried out, so it draws attention to the effectiveness of this instrument in other countries, with examples of sustainability indicators defined by standards with empirical experiences and international support, to be considered in reforms in monitoring issues.

Given the results obtained from the present study, in addition to the fact that Chile has proposed the need to measure and monitor urban environmental variables as part of its national urban development policy (2014), this study provides valuable information that should be considered in all future reforms to strategic environmental assessments.

Supplementary Materials: The followings are available online at https://www.mdpi.com/article/ 10.3390/su132212639/s1. Files S1 to S4 were

added to this article. Please check in submitted article.

Author Contributions: Conceptualization, O.R. and V.D.; methodology, O.R. and V.D.; formal analysis, O.R.; investigation, O.R. and V.D.; project administration, J.-L.A. and V.D.; writing—original draft and writing—review and editing, O.R., V.D. and J.-L.A.; funding acquisition, J.-L.A. and V.D. All authors have read and agreed to the published version of the manuscript.

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Capítulo V: Discusión General

Chile ha declarado en su política nacional la necesidad de medir y monitorear variables ambientales urbanas. Sin embargo, pese a la implementación de la EAE en Chile, existen brechas que impiden la incorporación de las variables ambientales a los instrumentos de planificación territorial (OECD, 2016). Las diferencias identificadas entre los modelos de seguimiento europeos analizados y el modelo chileno (como la posibilidad de modificar el instrumento por consideraciones ambientales y de adoptar medidas compensatorias), que quedan ratificadas con el análisis de los indicadores utilizados en los PRC en Chile, impulsa a avanzar en mejores niveles de adaptabilidad de los mecanismos para dotar a los instrumentos de planificación del país, en mejores posibilidades para identificar y compensar los efectos ambientales adversos que generen.

En los resultados expuestos en el capítulo III cuyo objetivo de investigación era conocer las diferencias entre los modelos de EAE en la incorporación de las variables ambientales, se advierten diferencias en los instrumentos de planificación territorial para las etapas posteriores a su aprobación.

En el caso de Francia y Portugal sus EAE desarrollan estándares comunes fijados por la Directiva 2001/42/EC del Parlamento Europeo y del Consejo relativos a la evaluación de los efectos de determinados planes y programas en el medio ambiente. Esta directiva requiere de la presentación de un *Informe Ambiental* que contiene la información requerida en el artículo 5 y Anexo I y se presenta al momento de requerirse la evaluación ambiental. Este se refiere no solo a medidas para prevenir, reducir y compensar los efectos negativos al medio ambiente (letra g del Anexo I), sino también una descripción de las medidas previstas para la supervisión de conformidad al artículo 10 de la Directiva, que es titulado “Supervisión” y, en detalle, exige supervisar los efectos de la aplicación de los planes y programas importantes para el medio ambiente para, entre otras cosas, identificar con prontitud los efectos adversos no previstos y permitirles llevar a cabo las medidas de reparación adecuadas. Por ello, tanto Francia como Portugal tienen normas que contemplan criterios, indicadores y métodos para analizar los efectos ambientales del instrumento (Artículo L-104-1 del Código de Urbanismo francés) o las medidas de control del artículo 11 del Decreto Ley Nº232 de Portugal, junto con la normativa específica para cada instrumento que les exige indicadores cualitativos y cuantitativos para evaluar los efectos significativos del instrumento (Decreto Ley Nº80-2015). En el caso chileno, los indicadores de seguimiento buscan evaluar los resultados del plan, por lo que en la práctica ha llevado a cumplir con esta exigencia incorporando solo indicadores urbanos (como crecimientos demográficos, áreas verdes, transporte) y no ambientales como podría ser efectos en aguas subterráneas (Delgado et al., 2017) o humedales (Rojas et al., 2019), emisión de contaminantes atmosféricos (Jorquera, 2020), presiones sobre la sustentabilidad (OECD, 2013), entre otros, lo que se agudiza si se considera que no hay fiscalización de estos instrumentos, por lo que la revisión es voluntaria y discrecional según la motivación de la autoridad (Consejo Nacional de Desarrollo Urbano, 2019).

Por otra parte, se determinó que Francia no tiene normas que obliguen a modificar un instrumento de planificación atendido los efectos ambientales que éste pudiere estar generando, pero sí se debe destacar que tiene normas que determinan plazos para modificar los instrumentos, teniendo en cuenta para ello los objetivos ambientales que se deben conseguir con estos instrumentos de planificación. Además, los planes locales de urbanismo (nivel vinculante) pueden ser revisados cuando haya modificaciones en medidas que protegen de graves riesgos de molestias y calidad de los lugares. Asimismo, destaca la protección de los Sitios Natura 2000 que corresponde a una de las redes de conservación de biodiversidad más importantes creadas en el mundo. Portugal contempla la posibilidad de realizar revisiones, alteraciones, suspensiones o revocaciones cuando se ponderan o evolucionan las condiciones de distinta índole dentro de las cuales se consideran las ambientales, las que además deben ser informadas periódicamente por los órganos responsables de cada instrumento. En cambio, Chile no tiene contemplada normativa que permita adecuar sus instrumentos de planificación cuando estén generando efectos imprevistos en el ambiente, aunque en su política nacional (que no es vinculante y sin estudios sobre su implementación) establece la necesidad de avanzar en indicadores ambientales. De todas formas, los instrumentos de planificación territorial en Chile tienden a ser inamovibles (Consejo Nacional de Desarrollo Urbano, 2019), ya que, si bien se puede confeccionar uno de ellos bajo esquemas de elaboración, modificación y enmienda, no tienen procedimientos propios y simplificados, lo que ha llevado a que los planes reguladores comunales tengan un promedio de antigüedad de 19 años (CNDU, 2019). Recientemente a través de una reforma del año 2018, se estableció que los instrumentos de planificación territorial deberán actualizarse periódicamente en un plazo no mayor a diez años, conforme a las normas que disponga la Ordenanza General.

Por otra parte, se obtuvo como resultado que los dos países europeos analizados, la normativa analizada exige la inclusión de medidas para evitar, reducir o al menos compensar los efectos del instrumento. Chile al respecto no dispone de una norma similar, ni en la EAE general ni en la específica de cada instrumento de planificación. Pese a que la reforma que introdujo la EAE en Chile (cuando) declaraba en sus motivos tener como objetivo el anticipar los eventuales efectos ambientales adversos asociados, o que puedan derivarse de la definición de una determinada política o plan y, de ese modo, considerar la prevención o mitigación de tales efectos o los mecanismos para evitar la generación de efectos ambientales acumulativos, siendo de aplicación obligatoria en el caso de los instrumentos de planificación territorial urbana (Biblioteca del Congreso Nacional, 2018, p. 3-9), en el plano normativo no se ha plasmado lo que existe en otras experiencias como las analizadas en este trabajo.. Si bien se declara en la normativa que se buscan incorporar las consideraciones de desarrollo sustentable a los instrumentos de planificación territorial, solo se hace en una etapa de diseño, no cuando el instrumento se encuentra ya aprobado y operando sobre el ambiente.

Todo lo anterior se debe conjugar con la característica del modelo de ordenación del uso de suelo seguido en Chile. De acuerdo a la regulación nacional asociada a los instrumentos de planificación, estos tienen un alcance exclusivamente asociado al uso de suelo urbano, por tanto en la planificación que ellos realicen

no se consideran instrumentos sectoriales como en materia energética, forestal, turísticos, indígenas, entre otros. Si bien en el momento que estos instrumentos de planificación urbana son sometidos a EAE, deben considerar "políticas medio ambientales y de sustentabilidad que pudieran incidir en la política, plan o instrumento de ordenamiento territorial que se pretende implementar" (artículo 14 letra b) del reglamento de EAE), no hay una norma que determine específicamente cuáles instrumentos o planes sectoriales deben considerarse, o a qué se refiere cuando se habla de "políticas medio ambientales y de sustentabilidad", o cuáles de esas "pudieran incidir" en el instrumento en evaluación, ni el cómo.

Ademas, Rozas-Vásquez et al. (2018) indica que los planes reguladores comunales no consideran acuerdos internacionales o de políticas ambientales nacionales o bien tienen una baja frecuencia en la consideración de políticas sectoriales (40%). Si bien los PROT buscan desarrollar un ordenamiento territorial abarcando áreas sectoriales, éstos aún no se encuentran en vigencia y su regulación establece que no pueden regular materias que tengan un ámbito de influencia u operación que exceda del territorio regional, ni áreas que estén sometidas a planificación urbanística. En cambio, en Portugal se exige una coordinación entre los distintos niveles de planificación (nacional, regional, subregional y municipal) y la integración de una amplia gama de políticas sectoriales (medio ambiente, transportes, educación, salud, etc.) y de participación ciudadana (Cavaco et al., 2019). Se aprecia en todos los niveles estudiados relaciones interdependientes contempladas en el decreto ley Nº80-2015 que establece la articulación entre los entes de la Administración Pública como un imperativo de actuación, de cara al desarrollo nacional, regional, subregional y municipal, comprometiendo soluciones expeditas de compatibilización entre programas y planes territoriales. Esta norma se encuentra respaldada en la Ley Nº32 donde ya en la definición de ordenamiento territorial se comprenden la preservación y defensa de suelos con potencial de uso con actividades agrícolas, ganaderas o forestales, conservación de la naturaleza, turismo y ocio, la producción de energías renovables o la explotación de recursos geológicos (artículo 37 letra d), adecuación de los niveles de densidad urbana, evitando la degradación de la calidad de vida (artículo 37 letra e) y recuperación y regeneración de áreas degradadas (artículo 37 letra j) ordenando que se realice una ponderación de los programas y planes territoriales para la armonización de los diversos intereses públicos con expresión espacial, teniendo en cuenta las estrategias de defensa nacional, seguridad, salud pública, protección civil y desarrollo, así como la sostenibilidad territorial, en términos económicos, social, cultural y medioambiental a medio y largo plazo (art. 39). En el caso de Francia, el artículo L-143-29 del Código de Urbanismo establece la obligación de revisar el Plan de Coherencia Territorial cuando prevea cambios a las orientaciones definidas por el proyecto de planificación y desarrollo sostenible, y a su vez los niveles inferiores los planes de urbanismo locales deben considerar a los esquemas de coherencia territorial (art. 131-2 del Código de Urbanismo); y en cuanto a los instrumentos que debe considerar el plan de urbanismo local, se contemplan las orientaciones generales

de las políticas de planificación, equipamiento, urbanismo, paisaje, protección de las áreas naturales, agrícolas y forestales, y preservación o restauración, buen estado de continuidad ecológica; pautas generales en materia de vivienda, transporte y viajes, redes energéticas, desarrollo de comunicaciones digitales, equipamiento comercial, desarrollo económico y actividades de ocio, adoptadas para todo el establecimiento público de cooperación intermunicipal o municipal (art. 151-5). Estas coordinaciones han sido útiles para el cumplimiento de medidas asociadas a reducir gases de efecto invernadero, identificando posibles compensaciones y sinergias entre estrategias de emisiones de largo plazo con otras estrategias sectoriales (Aguilar et al., 2020).

Las diferencias también se aprecian ante la posibilidad de que el instrumento se modifique atendido la evolución de las variables ambientales, dado que Chile solo contempla un criterio de actualización temporal (por el transcurso de un determinado tiempo), en tanto que Francia y Portugal no solo contemplan ese criterio, sino que consideran también la forma que el ambiente reacciona ante la implementación del plan. De esta manera, los instrumentos de planificación del territorio chilenos no tienen la posibilidad de adecuación y por tanto se mantienen rígidos en el tiempo sin poder evolucionar según sea las condiciones ambientales que se verifiquen por el transcurso del tiempo, lo que es más preocupante si se consideran los efectos en Chile del cambio climático, especialmente en relación a la sequía que afecta a gran parte del territorio.

Respecto de las medidas de compensación, están consideradas en los instrumentos de Francia y Portugal, en tanto que en Chile no hay normativa que regule el aspecto. En un plano normativo, esto demuestra no solo que los instrumentos de planificación del territorio no hacen seguimiento de los efectos ambientales y que son inflexibles, sino que además no tienen capacidad de reacción oportuna a los efectos imprevistos que generen.

En cuanto a la revisión del funcionamiento de la EAE en Chile, siguiendo los criterios de la OECD, los indicadores del tipo *pressure* ocupan un gran porcentaje de los utilizados dentro del área de estudio, es decir, los PRC que se someten a EAE se concentran en recopilar información que describirá qué tipo de presión y/o la magnitud que se generará con el instrumento. Fue común encontrar indicadores relativos al otorgamiento de permisos de construcción o número de construcciones que se esperan y no del efecto sobre el desarrollo sustentable o ambiental que tales construcciones provocarán. Solo un porcentaje menor (3%) incorpora indicadores del tipo *state*, que permitirían al órgano responsable conocer el estado el medio ambiente en que se encuentra actualmente o encontrará durante la implementación del PRC.

La revisión de los indicadores siguiendo los criterios de la Norma ISO 37120, confirma los hallazgos obtenidos con la revisión de los indicadores OECD, en el sentido que dentro de las 17 áreas descritas por la norma ISO mencionada, los indicadores utilizados están centrados en aspectos urbanos y de recreación (básicamente indicadores asociados a áreas verdes), los que alcanzan sobre el 60% de los indicadores registrados; pero no en la categoría ambiental.

Es posible explicar normativamente los resultados dado que el reglamento de la EAE chilena establece que se deberán identificar los criterios e indicadores de seguimiento destinados a controlar su eficacia, y se entiende como criterios de seguimiento a aquel conjunto de elementos de análisis destinados al conocimiento y evaluación, dentro de un plazo determinado, de los resultados de la implementación de una política, plan o instrumento de ordenamiento territorial sometido a EAE. Como la norma no define qué se entiende por "controlar eficacia" del PRC ni "los resultados de implementación" del PRC, los órganos responsables han podido cumplir con el requisito de aprobar la EAE del PRC centrándose en aspectos distintos a los ambientales o de desarrollo sustentable. Como muestran los resultados, la recomendación de las guías citadas al inicio de este trabajo tampoco han sido suficientes, pese a que amplía el alcance del uso de indicadores para evaluar el logro de los objetivos ambientales propuestos. Otra justificación tiene que ver con las materias que puede regular un PRC las que están centradas en materias urbanas (Cordero, 2015) por lo que no pueden establecer normas en otras áreas del desarrollo sustentable de las ciudades como propone la norma ISO 37120. Por tanto, la normativa limita las posibilidades de realizar un seguimiento a las consideraciones ambientales del desarrollo sustentable como busca el objetivo definido por el reglamento de la EAE chilena.

En trabajos previos vinculados a éste se ha podido concluir, por ejemplo, que los Servicios Ecosistémicos (SE) son considerados en todos los informes de EAE analizados (15 informes incluyendo instrumentos regionales, intercomunales, PRC) y que en la etapa de seguimiento se incluyen los SE (Rozas-Vásquez et al., 2018). Sin embargo, era necesario explorar qué ocurre en las etapas finales de la EAE y focalizados en PRC dado que son los instrumentos de planificación territorial que más son utilizados en Chile desde el punto de vista urbano (como se pudo observar en la figure 1 del capítulo IV), para determinar si existe diferencia entre la formulación de objetivos y lo que ocurre con los indicadores que operarán durante la implementación del PRC y la magnitud de ésta, en caso de existir. En ese sentido este trabajo contempló una muestra de 51 PRC dentro de las regiones con mayor población de Chile con los indicadores definitivos de cada instrumento.

La OECD informó que en Chile existía escasa evidencia sobre si la EAE ha contribuido de manera significativa a modificar los planes de desarrollo territorial, a fin de mitigar mejor los problemas ambientales en las zonas urbanas (OECD, 2016). Cabe señalar que el desafío no amerita solo una modificación normativa, pues los estudios ya realizados muestran que la etapa de seguimiento se limita a la preparación de informes de seguimiento o supervisión de los impactos (exigencias que no están consideradas en la normativa chilena). Otros estudios advierten que países sin reconocimiento legal de EAE, es igualmente posible encontrar que el seguimiento se hace en aspectos como gobernanza, planificación y gestión (Lobos & Partidario, 2014) lo que habla de la alta relevancia del tema tanto en los países analizados en este trabajo como aquellos países que fueron analizados en estudios previos.

Además, el uso de indicadores requiere de una selección minuciosa, no bastando la adopción de un conjunto de indicadores (como alguno de los dos conjuntos que se utilizaron en este trabajo) como estándar aplicable a todos los instrumentos sometidos a evaluación, dado que algunos problemas que se han detectado dicen relación con la limitación de algunos indicadores ambientales para medir solo algunos parámetros o tener una sensibilidad distinta a lo que se quiere monitorear atendido cuán rápido se efectúen los cambios ambientales (Puig et al., 2017); en otros casos será innecesario tener información demasiado detallada, pues puede derivar en confusiones para quien debe adoptar la decisión o dar una falsa impresión de precisión (Brandon & Lombardi, 2005). Para una adecuada incorporación de indicadores puede recomendarse seguir criterios previamente elaborados como los de Donnelly et al., (2007) o Button (2002), más que un conjunto ya establecido.

Los resultados muestran que los indicadores definidos por las autoridades responsables no se centran en el seguimiento de los efectos ambientales del PRC. Ejemplos de esta práctica son las ampliaciones de las infraestructuras viarias que no tienen en cuenta las emisiones de gases de efecto invernadero resultantes, o los indicadores sobre la concesión de permisos de construcción o el número de construcciones previstas, pero no cuál sería el impacto de dichas construcciones en el desarrollo sostenible o medioambiental, es decir, no vigilan los impactos medioambientales o los efectos en el desarrollo sostenible de las decisiones urbanísticas adoptadas. A pesar de que el PRC no tiene competencias en ciertas áreas de desarrollo sostenible definidas por la norma ISO, el objetivo de la EAE es asegurar la incorporación de consideraciones de desarrollo sostenible a los instrumentos de planificación del uso del suelo como el PRC, por lo que este análisis empírico (realizado sobre una muestra representativa de los indicadores utilizados en el PRC sobre las regiones más pobladas de Chile) demuestra la necesidad de modificar la normativa de la EAE, exigiendo indicadores que permitan un seguimiento de los impactos ambientales.

Respecto de estos resultados, es importante avanzar en nuevos aspectos que restan por conocer y que surgen a propósito de esta investigación, por ejemplo: ¿Qué ocurre con la información generada por los indicadores utilizados en la EAE de los PRC? ¿Es considerada esta información en reformas futuras del PRC? ¿Cómo lo aprendido con los indicadores de un PRC de una comuna sirve para la formulación de los nuevos PRC de la misma comuna? Todo lo anterior, se agrava si se considera que los instrumentos de planificación chilenos tienen un alcance exclusivo a lo que se defina dentro de los límites urbanos, sin considerar definiciones que se realicen en planes o programas sectoriales (energéticos, de aguas, forestales, entre otros), resultando, en consecuencia, limitados tanto por un aspecto geográfico por las materias de que tratan, sin existir normas de coordinación como en las experiencias comparadas revisadas.

Los efectos de las ciudades sobre el medio ambiente son una cuestión de actualidad mundial, por lo que comprender sus consecuencias es una tarea de especial relevancia, en la que la Evaluación Ambiental Estratégica es un instrumento que ha sido seleccionado para evaluar estos efectos. La mejora de la EAE dependerá, entre otros factores, de la forma en que afecte a los planes que diseñen las ciudades. En este sentido, los indicadores son una pieza clave

para evaluar las consecuencias de la implementación de planes y políticas, ya que ayudan a facilitar las comparaciones dentro de una misma ciudad y entre ciudades. Dados los resultados obtenidos en el estudio, además de que Chile ha planteado la necesidad de medir y monitorear las variables ambientales urbanas como parte de su Política Nacional de Desarrollo Urbano del año 2014, este estudio aporta información valiosa que debe ser considerada en todas las futuras reformas a las evaluaciones ambientales estratégicas.

Los resultados pueden ser útiles para otros países que han seguido modelos de EAE, ya que, según nuestra revisión bibliográfica, no se ha realizado un análisis empírico del uso de indicadores en los planes urbanos, por lo que se llama la atención sobre la eficacia de este instrumento en otros países, con ejemplos de indicadores de sostenibilidad definidos por normas con experiencias empíricas y apoyo internacional, para ser considerados en las reformas en temas de seguimiento.

Capítulo VI: Conclusión General

Se ha realizado un análisis de la etapa de seguimiento de la EAE en dos facetas: en su diseño normativo establecido en la regulación propia de la EAE como de los instrumentos urbanísticos en Chile y; en el uso empírico de indicadores ambientales con el objetivo de asegurar que los órganos responsables efectúan un seguimiento de los efectos ambientales que generan sus planificaciones urbanísticas.

Respecto al diseño normativo de la etapa de seguimiento, al órgano responsable del instrumento urbanístico sometido a EAE le puede resultar suficiente establecer medidas de seguimiento para ver los resultados del plan, por tanto, comprometerse a evaluar cómo reaccionará el medio ambiente al plan propuesto o cuáles servicios ecosistémicos podrían ponerse en riesgo por una decisión urbanística en el plan, son exigencias que no están expresamente comprendidas en la normativa. En tal sentido, los resultados expuestos en el Capítulo IV expresan que los órganos responsables no utilizan indicadores que les permita conocer los efectos ambientales de los planes reguladores comunales, sino más bien en registrar el efecto urbano del plan.

Chile ha definido en la EAE su herramienta para incorporar la variable ambiental a los instrumentos urbanísticos, aunque sin referirse a los servicios ecosistémicos propiamente tal, sino a las consideraciones ambientales de desarrollo sustentable. Sin embargo, existe una estrecha relación en saber los impactos que podría sufrir un ecosistema particular ante un plan urbanístico con los servicios que dicho ecosistema puede entregar y que también pueden resultar afectados.

En este punto, es importante recordar que la hipótesis de trabajo planteaba que para que los Servicios Ecosistémicos se incorporen a los instrumentos de ordenamiento territorial y en las políticas y planificaciones sectoriales con incidencia territorial, es necesario que se hagan en el marco de una Evaluación Ambiental Estratégica que exija expresamente la consideración de estos

servicios.

Al respecto, conceptualmente es posible abarcar en la expresión utilizada por el reglamento de la EAE “consideraciones ambientales de desarrollo sustentable” a los servicios ecosistémicos, y que no obstante ello, la incorporación de estas consideraciones en los instrumentos de uso de suelo como los urbanísticos es limitada, pues la reglamentación señala que los criterios de seguimiento del plan están destinados evaluar los resultados de su implementación, lo que empíricamente ha sido confirmado para el caso de los planes reguladores comunales. De esta manera, la hipótesis es rechazada porque la incoporación conceptual que se hace a través de “consideraciones ambientales de desarrollo sustentable” no se plasmó en la etapa de seguimiento analizada.

Respecto al objetivo de “Determinar las diferencias respecto a la consideración de los SE en las políticas y planificaciones sectoriales con incidencia territorial sometidas a EAE con aquellas que no se someten”, no fue posible dado que antes de la EAE, los instrumentos se sometían a evaluación de impacto ambiental principalmente a través de Declaraciones de Impacto Ambiental. Es decir, se trata de otro instrumento con regulación distinta y sin medidas de seguimiento (como se exigía a los Estudios de Impacto Ambiental) por lo que la comparación no era viable.

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