Desafíos y ejemplos de la Ciencia Ciudadana

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Jornada Ciencia Abierta en Biobío: Workshop Preprints

13 de Agosto de 2024

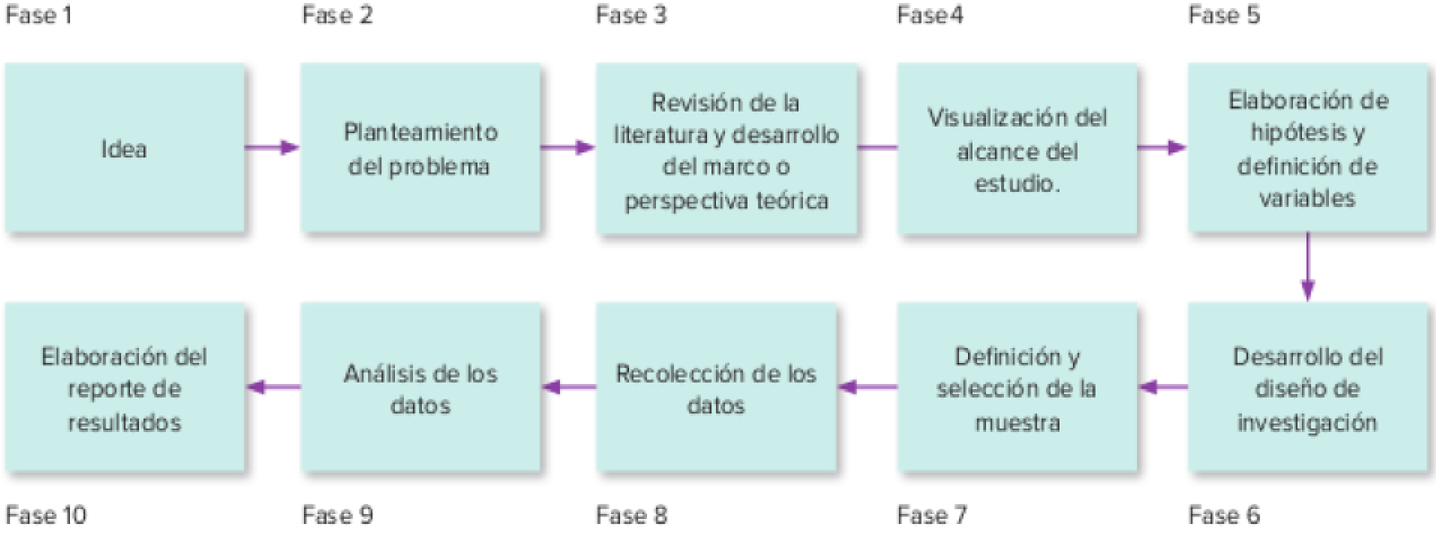
Investigación Científica

- “Conjunto de procesos sistemáticos, críticos y empíricos que se aplican al estudio de un fenómeno o problema con el resultado (o el objetivo) de ampliar su conocimiento, empleando el método científico”

- “Una estrategia sistemática para la generación de nuevo conocimiento, construida en base al trabajo previo en el área, pero sujeta a escrutinio para determinar sus fallas. Los resultados deben estar fundamentados y el trabajo debe ser reproducible.”

Investigación científica: Ruta cuantitativa

Podemos resumir las etapas fundamentales de la ruta cuantitativa de esta forma:



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CoastSnap: A global citizen science program to monitor changing coastlines

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ARTICLE INFO

Keywords:
crowdsourcing
Smartphone
Social media
Image processing
Coastal management

ABSTRACT

CoastSnap is a low-cost community beach monitoring program that turns everyday smartphones into devices to measure coastal response to storms, sea-level rise, human modifications and other factors. Underpinning CoastSnap is a stainless-steel smartphone cradle that is installed overlooking a beach in a location easily accessible to the public. Using the cradle for image positioning, passers-by simply take a photo of the coast and upload it to a centralized database, which in turn provides a crowd-sourced record of coastline change over time. Behind this simple idea are advanced image processing algorithms that then enable the shoreline position (and other coastal features) to be mapped from the community snapshots in a scientifically rigorous manner. First established in Sydney, Australia in 2017, the network of CoastSnap stations has grown rapidly over the past five years to now encompass 200 monitoring locations in 21 countries. Analysis of the 44 Australian stations managed by the Authors indicates strong community participation, with over 10,000 images and 4000 community participants to date and an image submission frequency ranging from approximately weekly to daily (average = 2.6 images/station/week). Example practical applications of CoastSnap include: as a tool to monitor high-frequency shoreline change and coastal inlet dynamics; to support conservation efforts on protected coastlines; and to directly inform the timing of dredging and beach nourishment activities. This paper describes the background and evolution of the project and discusses its successes, challenges as well as future directions.

1. Introduction

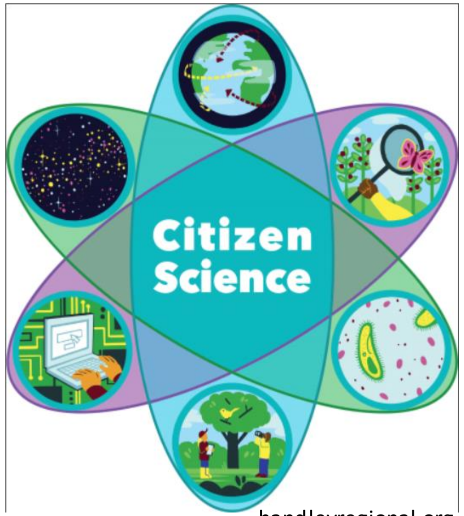
Community engagement in coastal research and management has been shifting in recent years from traditional modes of consultation, such as surveys, workshops and town hall meetings, to more active participation in knowledge development and decision making. This shift has been driven by a rapid growth in citizen science, which empowers local communities by placing them at the centre of data collection, processing and, in some cases, analysis (Wehn et al., 2021). Successful citizen science projects should aim to develop scientifically rigorous datasets and knowledge while relying on community participation in one or more key activities (Roger et al., 2019). The citizen scientist's role

economic values in dynamic coastal settings and their associated risks. Engagement in coastal research and management through citizen science also presents opportunities for developing and delivering community education programs, which may be core components or extensions of a coastal citizen science project.

The recent growth of citizen science in coastal research has accompanied increasing awareness that effective and acceptable solutions to key problems in the crosshairs of applied researchers (such as mitigating coastal erosion impacts) cannot be attained when viewed only as physical problems, and, that future coastal processes and dynamics will depend on the coastal management interventions of today (Lazarus et al., 2016). This recent paradigm of thinking acknowledges human

La mayoría de sus investigaciones deberían seguir una lógica similar. Aún cuando en muchos ocasiones hay traslape entre estos pasos, el orden es normalmente respetado.

Ciencia Ciudadana (Citizen Science):



handleyregional.org

fritsahlefeldt.com

- El compromiso del público general en actividades de investigación científica
- Los participantes proveen datos experimentales o equipos a los investigadores
- La ciudadanía aporta también análisis de datos o incluso forma parte del diseño de la investigación.
- Los voluntarios, a la vez que aportan valor a la investigación, adquieren nuevos conocimientos o habilidades, y un mejor conocimiento del método científico de una manera atractiva.

Ciencia Ciudadana

Los proyectos de ciencia ciudadana podrían clasificarse en función de su tipo de participación voluntaria:

- Proyectos contributivos: los participantes contribuyen en la recopilación de datos y puntualmente ayudan a analizarlos y difundir resultados.
- Proyectos colaborativos: los participantes también analizan muestras y en ocasiones ayudan a diseñar el estudio, interpretar los datos, sacar conclusiones o difundir los resultados.
- Proyectos co-creados: también conocida como ciencia ciudadana extrema en la que los participantes colaboran en todas las etapas del proyecto, incluyendo definición de preguntas, desarrollo de hipótesis, discusión de resultados y respuesta a nuevas preguntas.
- Aprendizaje basado en proyectos: los participantes son estudiantes supervisados por educadores u otros adultos

www.unsw.edu.au

hubbardbrook.org/community-partnerships-citizen-science/

zentrumfuercitizenscience.at/en/citizen-science/citizen-science-in-schools

Ciencia Ciudadana

Beneficios para la Ciencia
Aumento de la cantidad de datos recogidos
Ampliación de la cobertura geográfica de los estudios
Inclusión de perspectivas diversas

Beneficios para los Ciudadanos
Educación y concienciación
Participación en la toma de decisiones
Desarrollo de una comunidad interesada en la ciencia

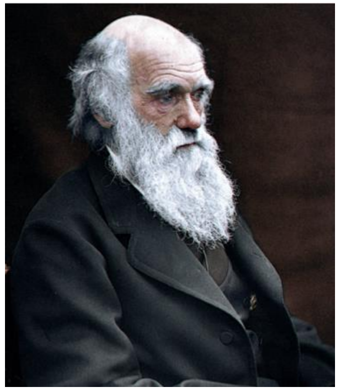
Historia de la Ciencia Ciudadana

1) Primeros Naturalistas:
1700s - 1800s: Durante el siglo XVIII y XIX, muchos científicos comenzaron como naturalistas amateurs (Carl Linnaeus, Charles Darwin). **John James Audubon (1785-1851):** Publica "The Birds of America" entre 1827 y 1838, documentando y pintando aves en su hábitat natural

2) Formalización de la ciencia ciudadana:
1900-1950: Christmas Bird Count (EE.UU.) Cada año, miles de voluntarios participan en el conteo de aves. Monitoreo de Aves en el Reino Unido.

3) Era Digital:
1970-1990: Proyectos de Monitoreo Ambiental donde ciudadanos monitorean la calidad del agua, la contaminación del aire y otras variables ambientales. SETI@home utiliza conectividad de internet para analizar datos de radiotelescopios en la búsqueda de señales de inteligencia extraterrestre

4) Globalización y Diversificación (2000's):
Zooniverse (2009): plataforma que permite participar en una amplia gama de proyectos, desde la astronomía hasta la historia. **iNaturalist (2008):** Iniciada como una tesis de maestría en la Universidad de California, ciudadanos de todo el mundo pueden documentar especies, ayudando a científicos a estudiar la biodiversidad global. En 2010 **Proyecto Glaciares en Argentina** utilizan datos ciudadanos para estudiar el retroceso glaciar, y **Globe at Night** permite a los ciudadanos medir la contaminación lumínica



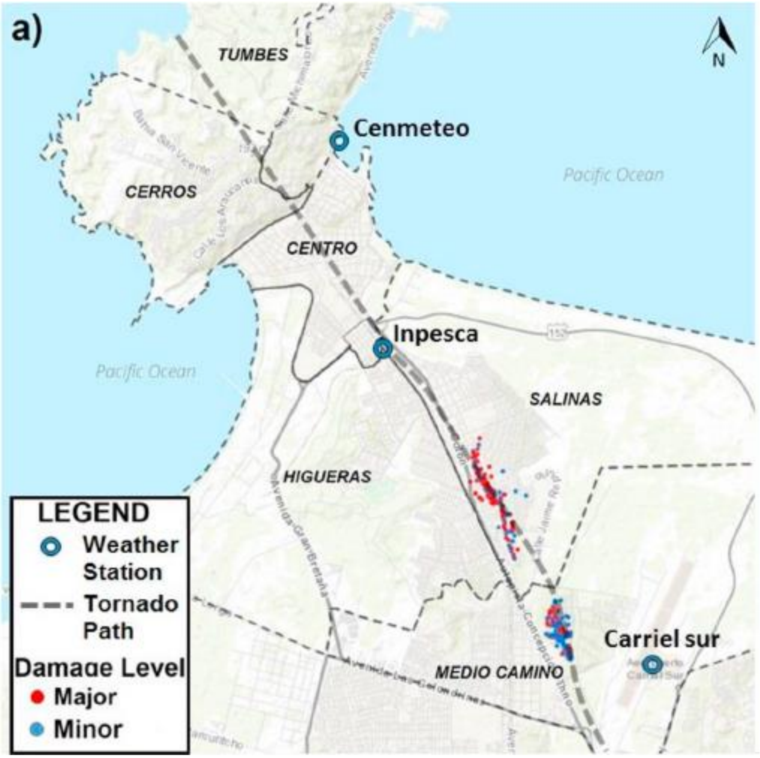
5) Presente y Futuro
Redes Sociales, permite ampliar la participación

Inteligenica Artificial y Ciencia Ciudadana (procesamiento de enormes volúmenes de datos)

Nuevos Campos, se está expandiendo a la salud pública y recolección de enfermedade, por ejemplo: COVID-19 Citizen Science (CCS), que utiliza cuestionarios a través de smartphones.

Ejemplos de Ciencia Ciudadana

Levantamiento de información de daños luego del tornado de Talcahuano en 2019 (contributivo)



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Damage assessment of the May 31st, 2019, Talcahuano tornado, Chile

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ARTICLE INFO

Keywords:
Field survey
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Talcahuano
Tornado

ABSTRACT

On May 31st, 2019, a tornado hit the city of Talcahuano, Chile, generating significant damage to structures and leaving one person dead. The objective of the present paper is to report on damage to structures in Talcahuano. A preliminary survey was performed by the Municipality of Talcahuano and covered the entire affected area with a cellphone web application used to report the severity and distribution of damage. A more comprehensive damage survey was conducted in the *Brisa del Sol* neighborhood in the *Medio Camino* area by the UCSC team to assess the damage distribution within an area with well-defined and homogeneous building typologies. The results of the field surveys showed that the tornado behaved as a skipping tornado and that most damage to houses consisted of wall opening damage, roof sheathing failure, and wall cover removal (EF0), followed by partial roof removal (EF1). It was noticeable that self-built systems (house additions) were more damaged than original houses, which may be explained by the fact that such structures do not always meet minimum building standards. It is recommended that field surveys conducted by municipalities and the Ministry of Social Development consider typical damage types rather than just categories such as minor, moderate, or major. Finally, it is recommended that the feasibility of implementing mitigation measures such as stricter wind load provisions and dual-objective tornado design philosophy in the Concepción-Talcahuano area be analyzed.

1. Introduction

On May 30th and 31st, 2019, two destructive tornado events affected the cities of Los Angeles and Talcahuano, respectively, in the Biobio Region, Chile [1]. A preliminary analysis assigned an intensity of EF2 to the Los Angeles event and EF1 to the Talcahuano event, according to the Enhanced Fujita (EF) scale [2], which ranks tornado intensities based on damage to houses, trees, and cars [3] on a scale of EF0 to EF5. Despite the severity of the events, only one death was reported [4]. It was of wind gusts and instability. These phenomena typically occur over plains, with their paths spanning only few kilometers in length, and are often less than 100 m in width and short-lived [5]. They are typically observed in the United States (Tornado Alley), where tornadoes have become one of the most devastating natural hazards and there are 1200 events per year, on average [6,7]. Such hazards are less frequent in Chile, but they have been observed regularly over the years, mainly in rural areas. In fact, according to Bastías-Curivil [8]; at least 57 tornadoes have been observed in Chile since 1633, and most of them have occurred

3. Methodology

Talcahuano is a city that, due to geographical conditions and industrial activities, is exposed to both natural and anthropogenic hazards such as earthquakes, tsunamis, landslides, water pollution, oil spills, and industrial accidents, among others. Therefore, the Municipality of Talcahuano has developed several strategies to manage disaster risk. After the 2010 earthquake and tsunami, the local authorities formed the Department of Integrated Disaster Risk Management (Departamento de Gestión Integral del Riesgo, DGIR), which is responsible for planning, executing, and disseminating specific actions to reduce both natural and man-made disasters. In addition, the territory has been divided into six areas to provide more effective surveying and community assistance during emergency events. The areas are: (i) *Tumbes*, (ii) *Cerros*, (iii) *Centro*, (iv) *Salinas*, (v) *Higueras*, and (vi) *Medio Camino* (see Fig. 1). Even though tornado hazard has not been considered in the current risk reduction plans, the city is often affected by strong winds in winter. Therefore, the DGIR teams applied current protocols to survey the tornado-affected areas. After the event, several teams from the DGIR and UCSC (Universidad Católica de la Santísima Concepción) conducted a field survey to collect data on the damage within the tornado's path. The survey included expert observation, photos and aerial images taken by an unpiloted aerial vehicle (UAV) to capture the spatial distribution of damage (see Fig. 2).

The DGIR conducted a preliminary survey with the assistance of 155 volunteers from NGO ADRA Chile,[1] the Civil Defense and The National Youth Institute (Instituto Nacional de la Juventud, INJUV). This survey was carried out 24–36 h after the tornado, covered a total area of ~6 km^2, and sought to identify areas in which immediate assistance needed to be prioritized. Data were collected by means of a cellphone web application called Survey 123 for ArcGis. A typical form is shown in Supplementary Material. Not all volunteers had experience with damage assessment; therefore, one representative of the DGIR led a short training session on damage levels and the cellphone application. Two damage levels were used: major and minor. These damage levels were defined based on qualitative assessment. Major damage consisted of structural damage such as roof loss and damage to exterior walls, while minor damage was defined as loss of exterior wall cover, broken glass and/or damage to perimeter fences. In addition, volunteers could add a comment and a picture of the house in case it needed to be re-assessed. The main advantage of this survey was that all collected information was received in real-time by the DGIR, allowing local authorities a true understanding of the impact of the tornado in a short time.

Ejemplos de Ciencia Ciudadana

COASTAL ENGINEERING JOURNAL
https://doi.org/10.1080/21664250.2020.1780719

JSCE Taylor & Francis

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The 2018 Sulawesi tsunami in Palu city as a result of several landslides and coseismic tsunamis

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ABSTRACT

The September 28 2018 Palu tsunami surprised the scientific community, as neither the earthquake magnitude nor its strike-slip mechanism were deemed capable of producing the wave heights that were observed. However, recent research has shown that the earthquake generated several landslides inside Palu bay. The authors conducted a post-disaster field survey of the area affected to collect spatial data on tsunami inundation heights, nearshore and bay bathymetry, and carried out eyewitness interviews to collect testimonies of the event. In addition, numerical simulations of the tsunami generation and propagation mechanisms were carried out and validated with the inferred time series. Seven small submarine landslides were identified along the western shore of the bay, and one large one was reported on the eastern shore of Palu City. Most of these landslides occurred at river mouths and reclamation areas, where soft submarine sediments had accumulated. The numerical simulations support a scenario in which the tsunami waves that arrived at Palu city 4–10 min after the earthquake were caused by the co-seismic seafloor deformation, possibly coupled with secondary waves generated from several submarine landslides. These findings suggest that more comprehensive methodologies and tools need to be used when assessing probabilistic tsunami hazards in narrow bays.

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KEYWORDS
Palu city; landslide tsunami; numerical simulation

1. Introduction

On September 28, 2018, an earthquake of moment magnitude Mw. 7.5, with its epicenter located at 0.18°S and 119.85°E, occurred in Sulawesi Island, Indonesia. Tsunami waves were reported in several areas inside Palu Bay only a few minutes after the earthquake, with unexpectedly large inundation heights observed at Palu City (Mikami et al. 2019; Omira et al. 2019) (Figure 1). There were over 2020; Takabatake et al. 2019). Recent research indicates that the Palu earthquake ruptured at supershear velocities (Socquet et al. 2019; Bao et al. 2019) and additional non-tectonic sources contributed to the generation of the tsunami, including landslides and liquefied gravity flows (Heidarzadeh, Muhari, and Wijanarto 2018; Takagi et al. 2019; Sassa and Takagawa 2018; Pakoksung et al. 2019; Carvajal et al. 2019; Arikawa et al. 2018; Gusman et al. 2019). Ten possible locations where coastal landslides could have

Datos desde RRSS y videos subidos por la comunidad en el sismo y tsunami de Palu, 2018 (contributivo)

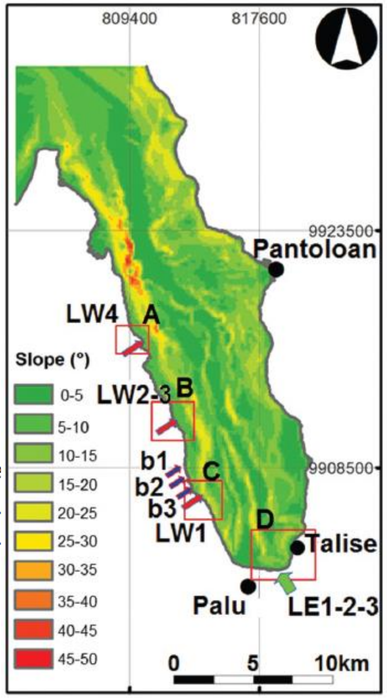
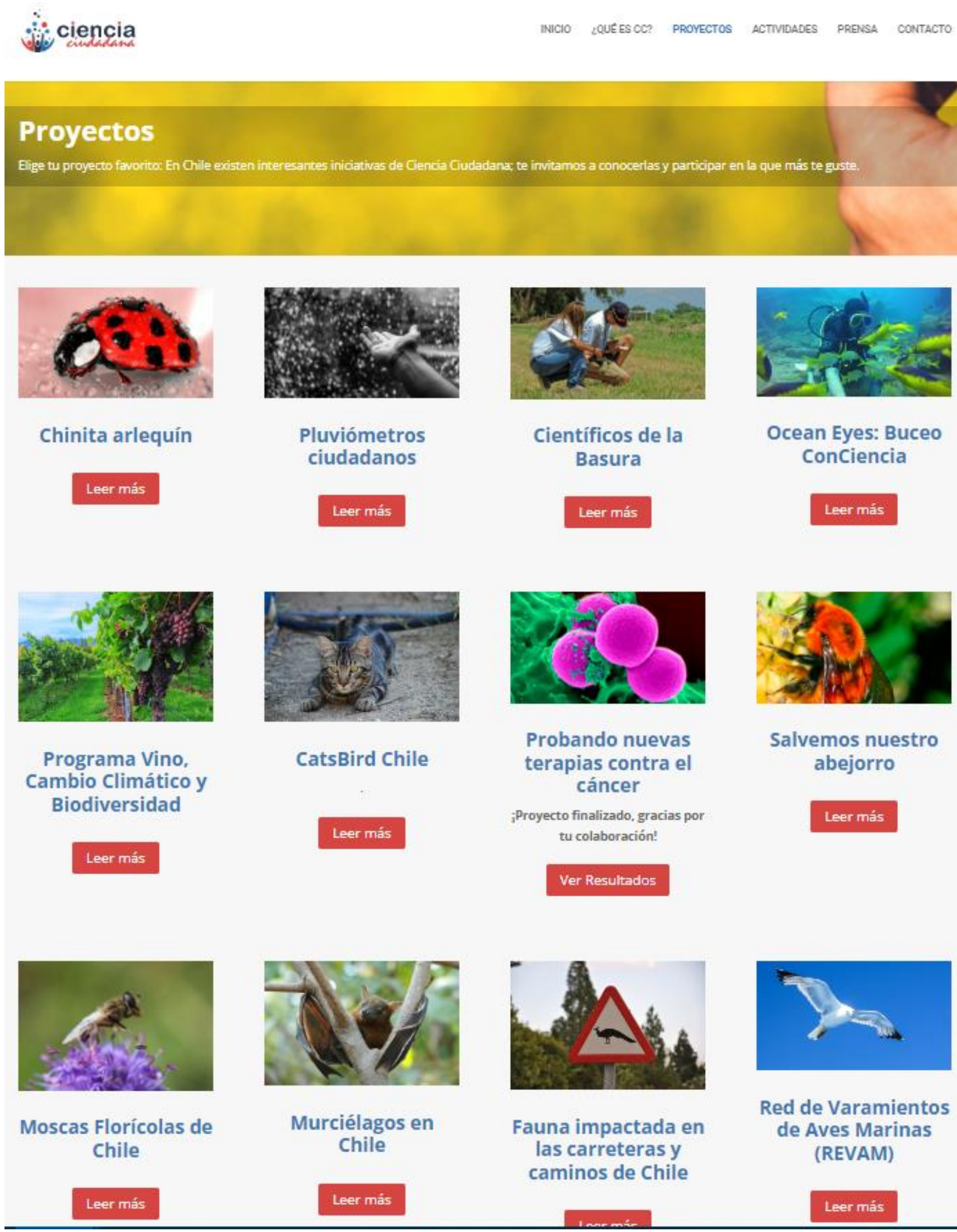


Table 2. List of videos which were analyzed to identify landslide location, wave arrival time and direction. All hyperlinks were available as of December 7 2018.

Video N°	Location	Description	Link
1	Shopping center, 0°53′1.75″S 119°50′38″E	Arrival of first wave at Palu City	https://www.youtube.com/watch?v = mOEfs2Foh7E
2	Shopping Center: 0°53′1.75″S 119°50′38″E	Arrival of second wave at Palu City	https://www.youtube.com/watch?v = uCr5MgP5VVs
3	Antena at TVRI area 0°53′12.83″S 119°51′49.16″	Generation of landslide tsunami at East side of Palu Bay	https://www.youtube.com/watch?v=xplXjWMf7QM
4	Kampoeng Nelayan Hotel, Talise 0°51′55.07″S 119°52′38.81″E	Earthquake and Arrival of first wave at Talise area (Palu City)	https://www.youtube.com/watch?v=w6FYVCq3-as
5	Barge, 0°50′31.4″S 119°49′02.0″E	Generation of landslide tsunamis at the west coast of Palu Bay	https://www.youtube.com/watch?v=61ItBgIP-YM
6	Vessel inside the bay: location unknown	Generation of landslide tsunami in some point inside the bay	https://www.youtube.com/watch?v=KtQUntAHjE4

[3]https://www.paraview.org/

Ciencia ciudadana en Chile



Proyectos de Ciencia Ciudadana en Chile

Ejemplos de Ciencia Ciudadana

Pluviómetros Ciudadanos: Para medir aguas lluvias

Dirección General de Aguas
Ministerio de Obras Públicas
Gobierno de Chile

INICIO | QUÉ ES Y COMO USAR UN PLUVIÓMETRO | INGRESO DE MEDICIONES

Inicio

Pluviómetros Ciudadanos

Queridos participantes, sean todos bienvenidos a la red de medición de los recursos hídricos del país.

El proyecto "Pluviómetros Ciudadanos" es una iniciativa de la Dirección General de Aguas (DGA), a través d la cual los invitamos a participar como voluntarios en las mediciones del programa "Mi lluvia" de la zona dónde viven.

Como todos sabemos, el agua es un recurso estratégico para la vida y desarrollo del país, por lo que toda l información que pueda ser recopilada es fundamental para realizar una administración sustentable del recurso. Ahora bien, ¿cómo hacerlo? Esto es muy fácil y los ayudará a conocer las características pluviométricas de la zona, además del ciclo del agua en la naturaleza. Sólo basta con su compromiso.

Los animamos a participar en esta actividad, dónde todos cuentan y sin duda es una contribución muy significativa para nuestro país.

Muchas gracias. Contamos con cada uno.

Dirección General de Aguas - Ministerio de Obras Públicas - Teléfono: +56 2 4493810 HTML 5 | CSS 3 | CC

¿Cómo usar un Pluviómetro?

Instalación:

El lugar de instalación para este instrumento, debe tener algunas características específicas:

1.- Evite los obstáculos circundantes cercanos como árboles, ubicar el sector más despejado orientado hacia el poniente (

2.- Nunca se debe instalar un pluviómetro pegado a una mur techumbre, bajo cables eléctricos, tendederos o bajo el rama

3.- Determinada la ubicación, instale el poste de soporte del quede en posición vertical.

Pluviómetro "A":

La boca de captación del instrumento recibe la lluvia y las transmite a un tubo de medición o colector que está graduado de 0.0 a 25.0 mm. La escala de medición de este colector, permite identificar fácilmente hasta medio milímetro de lluvia; es decir, por ejemplo, que entre los 10.0mm y los 11.0 mm de la escala se puede identificar el 10.5 mm sin mayor problema.

Dirección General de Aguas
Ministerio de Obras Públicas
Gobierno de Chile

INICIO | QUÉ ES Y COMO USAR UN PLUVIÓME

Inicio » Ingreso de mediciones

Ingreso usuario

Nombre de Usuario:

Contraseña:

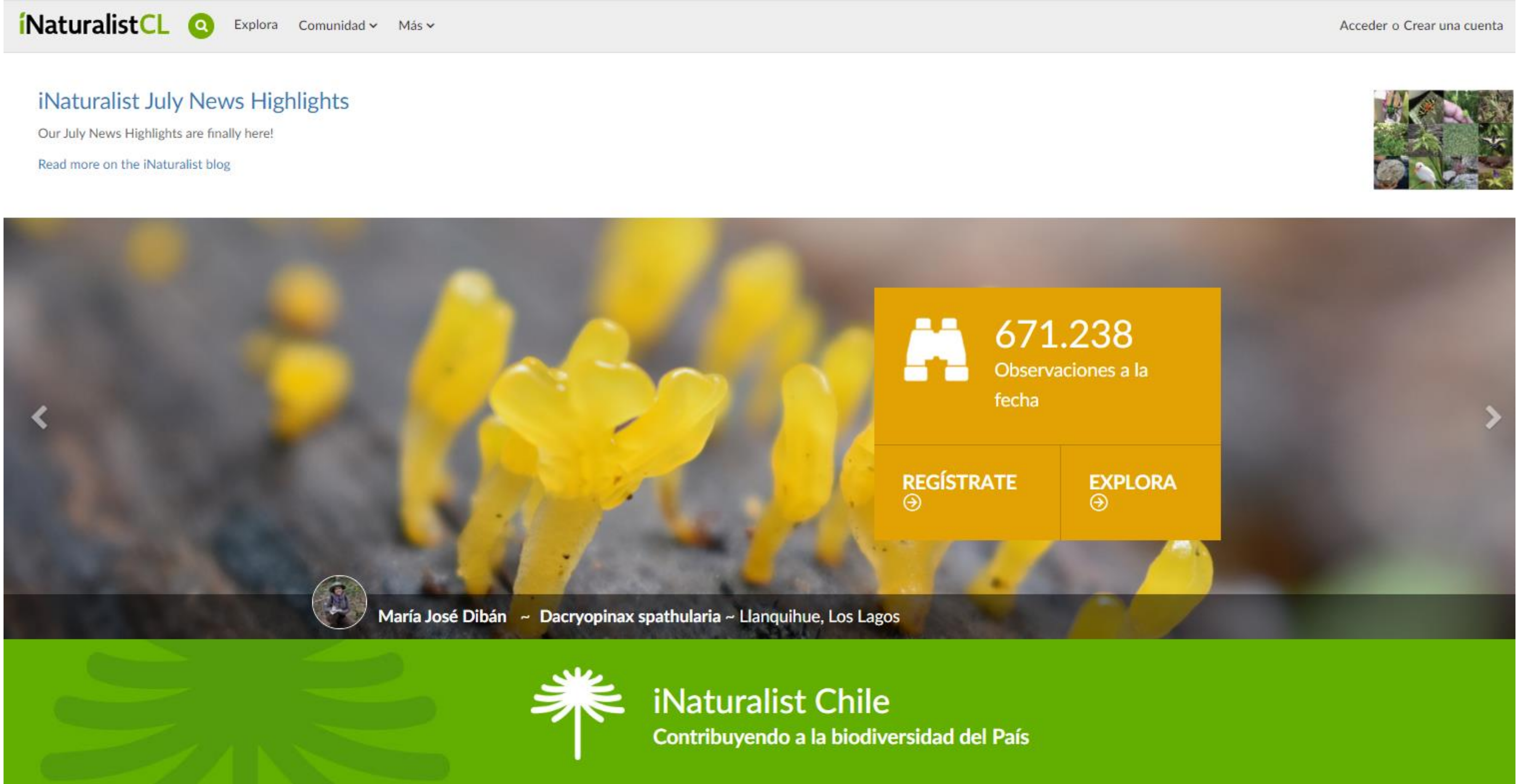
Ingresar

Dirección General de Aguas - Ministerio de Obras Públicas - Teléfono: +56 2 24493810

Ejemplos de Ciencia Ciudadana

iNaturalist

Chile

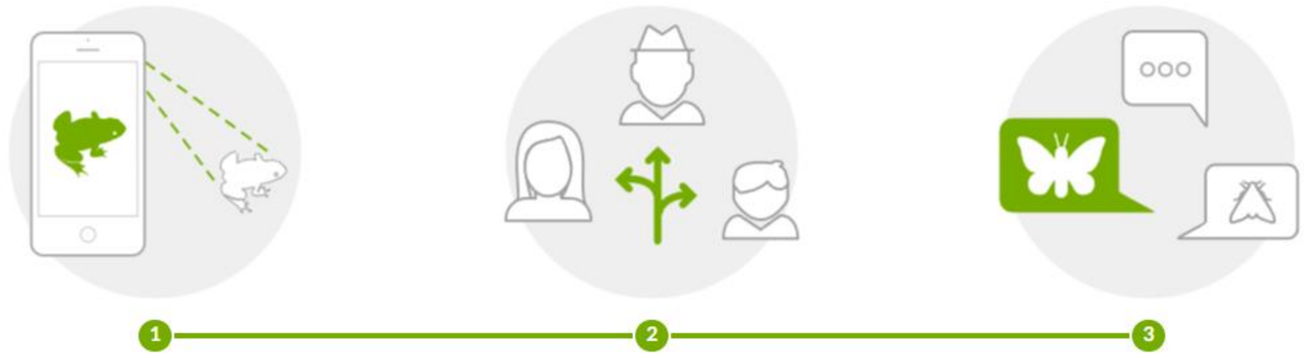


Ejemplos de Ciencia Ciudadana

iNaturalist

Chile

Cómo funciona



1 Registra tus observaciones

2 Compártelas con otros naturalistas

3 Dialoga con expertos y aficionados

Contribuye con la **Biodiversidad de Chile**

iNaturalist es una plataforma que permitirá a Chile fomentar la observación de la naturaleza, así como el registro y divulgación de nuestra biodiversidad. Con esta plataforma se podrá conocer más acerca de la distribución y ciclos de vida de las especies que habitan en nuestro país.

Es una invitación para que todo aquel interesado y amante de la naturaleza, y quienes deseen conocer más sobre la biodiversidad de Chile, puedan participar utilizando esta herramienta de ciencia ciudadana, contribuyendo con información que fortalezca el conocimiento, la investigación científica, la gestión pública para la conservación y, por supuesto, el amor por el patrimonio natural de Chile

Ejemplos de Ciencia Ciudadana

CoastSnap
community beach monitoring

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Revolutionising coastal monitoring, one social media photo at a time

CoastSnap is a network of simple camera mounts at beaches that invite the public to take a photo and upload it to social media. Photo: Larry Paice.

An innovative community beach monitoring program, CoastSnap, is turning average citizens into coastal scientists to help predict coastline changes.

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CoastSnap: A global citizen science program to monitor changing coastlines

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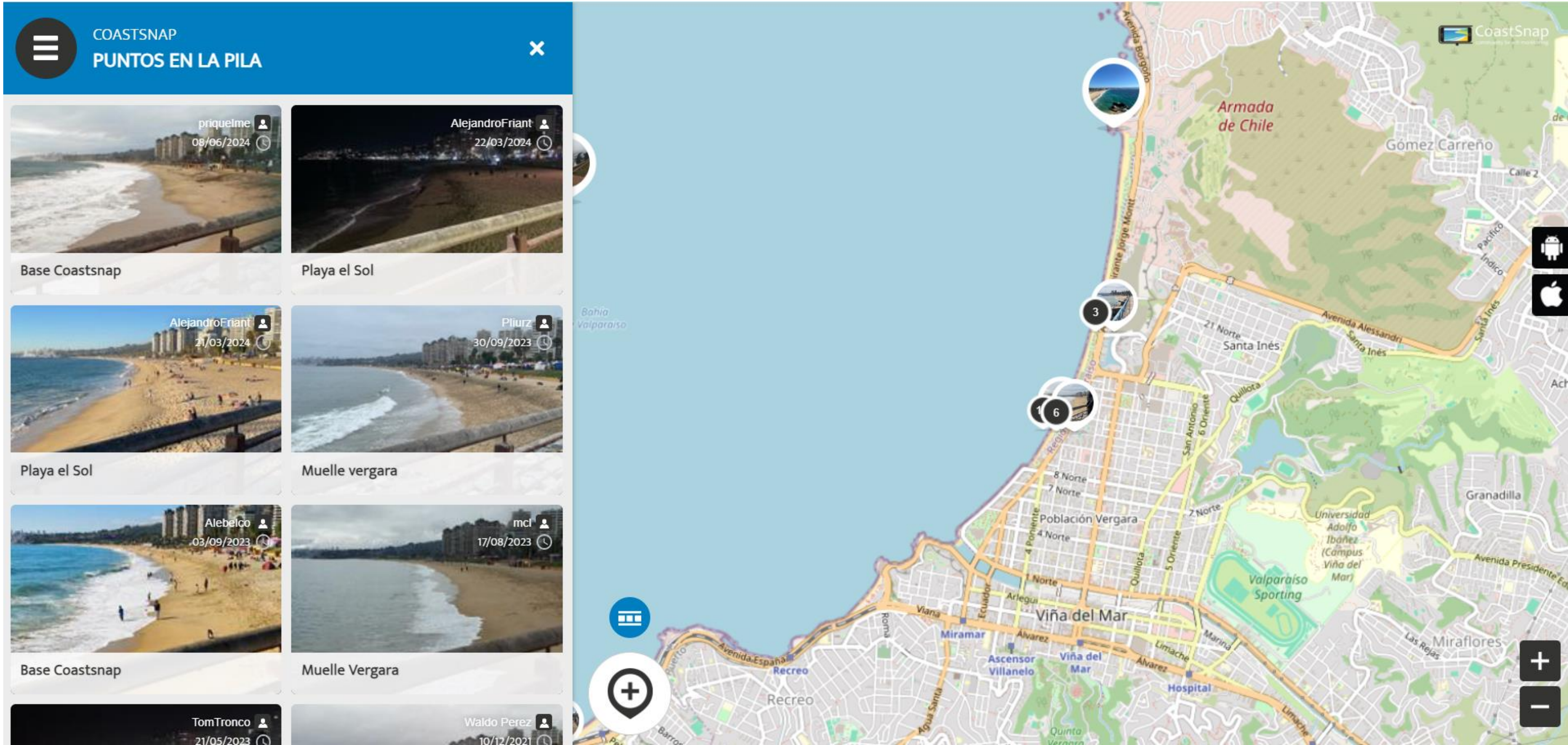
1. Introduction

Community engagement in coastal research and management has been shifting in recent years from traditional modes of consultation, such as surveys, workshops and town hall meetings, to more active participation in knowledge development and decision making. This shift has been driven by a rapid growth in citizen science, which empowers local communities by placing them at the centre of data collection, processing and, in some cases, analysis (Wehn et al., 2021). Successful citizen science projects should aim to develop scientifically rigorous datasets and knowledge while relying on community participation in one or more key activities (Roger et al., 2019). The citizen scientist's role

economic values in dynamic coastal settings and their associated risks. Engagement in coastal research and management through citizen science also presents opportunities for developing and delivering community education programs, which may be core components or extensions of a coastal citizen science project.

The recent growth of citizen science in coastal research has accompanied increasing awareness that effective and acceptable solutions to key problems in the crosshairs of applied researchers (such as mitigating coastal erosion impacts) cannot be attained when viewed only as physical problems, and, that future coastal processes and dynamics will depend on the coastal management interventions of today (Lazarus et al., 2016). This recent paradigm of thinking acknowledges human

Ejemplos de Ciencia Ciudadana



Relación Ciencia Abierta y Ciencia Ciudadana

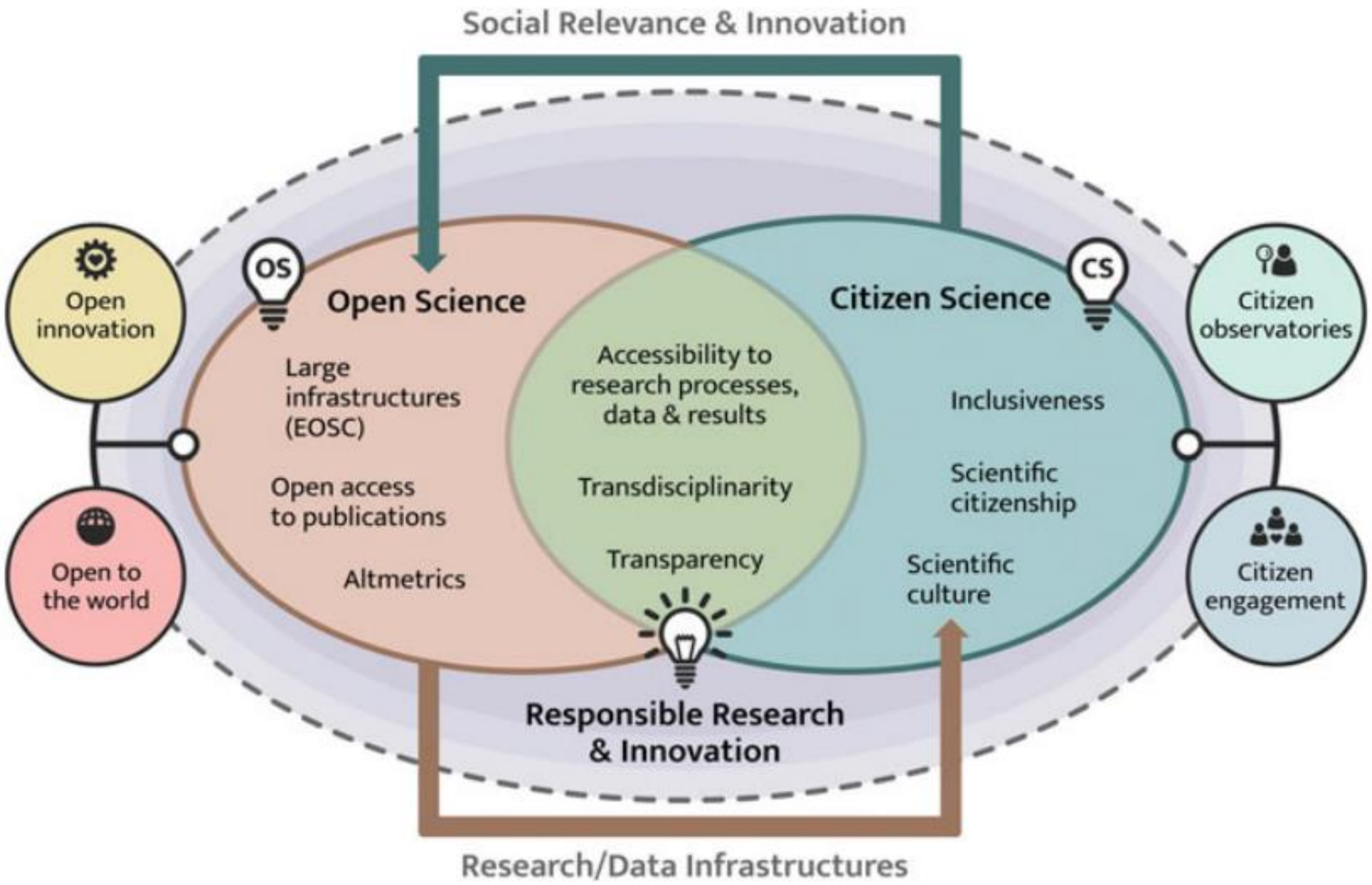
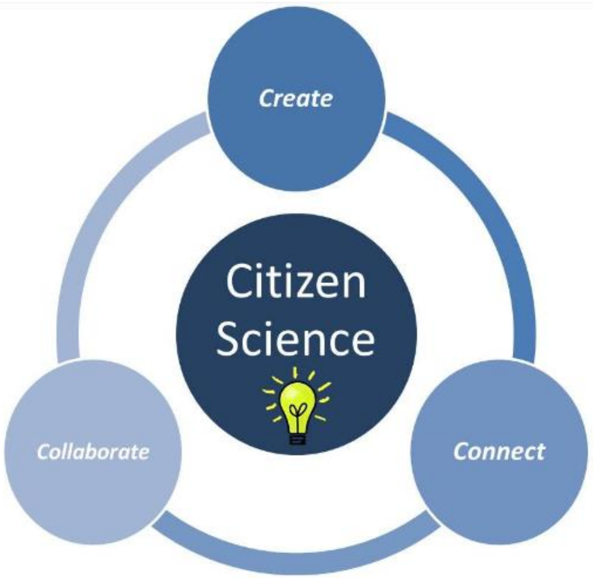


Fig. 18.2 The relationship between citizen science and open science. (Based on Vohland and Göbel (2017), modified)

Shade et al (2021)

Desafíos presentes y futuros de la Ciencia Ciudadana

- **Calidad y Fiabilidad de los Datos:** los participantes pueden no tener formación científica, existe el riesgo de que los datos sean inconsistentes o incorrectos
- **Inclusión y Diversidad:** Iniciativas que promuevan la inclusión de comunidades marginadas y que faciliten el acceso a la tecnología pueden ayudar a diversificar la participación
- **Propiedad y Ética de los Datos:** Los participantes pueden no estar conscientes de cómo se utilizarán sus datos o pueden no recibir crédito adecuado por su contribución
- **Protección de la Privacidad:** Desarrollar políticas de privacidad robustas y utilizar tecnologías de anonimización puede ayudar a proteger la identidad de los participantes y garantizar el uso ético de la información
- **Integración de Resultados en la Política Científica:** Establecer estándares y protocolos claros para la integración de datos de ciencia ciudadana en la investigación y en la toma de decisiones políticas puede aumentar la credibilidad y la utilización de estos datos



Gracias por su atención

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