Navigating the science policy interface: A co-created mind-map for early career researchers

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Abstract / Summary

The science-policy interface (SPI) is a complex space, in theory and practice, that sees the interaction of various actors and perspectives coming together to enable scientific knowledge to support decision-making. Early Career Researchers (ECRs) are increasingly interested in engaging with SPI, with the number of opportunities to do so increasing at national and international levels. However, there are still many challenges limiting ECRs participation, not least how such a complex space can be entered and navigated. While recommendations for engaging with SPI already exist, these do not always connect deeply enough with the context in which ECRs find themselves working. With the purpose of facilitating the engagement of ECRs working in biodiversity and ecosystem services in SPI, the authors have co-created a 'mind-map' - a navigational aid to help understand the landscape of and leverage access to SPI. This mind-map was developed through reviewing published literature, collating personal experiences of the ECR authors, and collecting perspectives in an ECR workshop during the 7th Plenary of the *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES). This co-created mind map sees ECR engagement in SPI as an interaction of three main factors: the *environment* of the ECR, which mediates their *acts of engagement* with SPI leading to *outcomes* that will ultimately have a reciprocal impact on the ECR's environment.

Keywords: *Biodiversity, Boundary Organizations, Capacity Building, Ecosystem Services, Science-Policy Interface*

1. Introduction

Globally, we are facing a set of unprecedented social-ecological crises, including dramatic losses of biodiversity, land use change, and climate change (Steffen et al. 2015; IPCC 2019; IPBES 2019). Addressing these challenges requires strategies informed by relevant, robust and timely knowledge (Pullin and Knight 2001, 2012; Sutherland et al. 2004; Rose 2015, Renn 2019). Scientific knowledge has a large role to play and researchers and practitioners in the fields of biodiversity and ecosystem services are increasingly encouraged to engage in science-policy interface (SPI) work as a means of supporting science-informed, co-created, policy-making on these crucial topics through initiatives such as the *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES) (Jaeger-Erben et al. 2018, Renn 2019).

SPI represents a boundary between the knowledge, norms, and approaches of science and policy. It frames science as a critical element in the process of developing policies (Frost et al. 2017). Through the lens of SPI, the policy-making process is presented as a space for knowledge gathering and interpretation, benefitting from a solid research base which helps to set the ground and the context for problem framing and policy formulation (Evans and Cvitanovic 2018). SPI work ideally requires a transdisciplinary[1] approach that encourages constructive knowledge exchange and co-creation between a diverse range of researchers and practitioners.

A range of factors impact how decision-makers use knowledge including: institutional and organisational factors, characteristics of the various actors involved in knowledge generation, and factors affecting the direct applicability of the knowledge (Soomai 2017). Differing interpretations of issues by scientists and policy makers, common for complex and emerging topics such as climate change, can preclude relevant scientific information from policy arenas (Naustdalslid 2011) and create bias in the issues which are engaged with. The gap between science and policy is further widened as scientists and policy makers can have different motivations, pressures and timescales shaping their work (Jones and Jones 2008).

SPI work can, therefore, be complex to navigate as it requires bringing together multiple actors with diverse knowledge and worldviews to facilitate the process of negotiation towards decision-making while navigating complex sets of priorities, jurisdictions and institutional settings (Lemos and Rood 2010; Bednarek et al. 2018). Although integrated approaches connecting science, policy and practice, such as IPBES are increasingly common and visible, the structure and operation of such efforts is complex and both the entry points and the most effective ways to contribute can be difficult to identify (Bednarek et al. 2018).

As a group of ECRs engaged in SPI, the authors acknowledge that the SPI space can seem extremely intimidating. From the perspective of an ECR, the already complex space of SPI, with its apparently numerous but unclear entry points, can be further complicated by time and resource constraints, a lack of specialized training, limited personal networks, and a smaller track record of previous work. Working in SPI often requires engaging with unfamiliar colleagues including decision-makers, representing important decision-making bodies, and senior scientists with many years of experience. These factors can lead to a reduced awareness of opportunities, lack of invitations to engage and

[1] "Transdisciplinarity is a reflexive, integrative, method- driven scientific principle aiming at the solution or transition of societal problems and concurrently of related scientific problems by differentiating and integrating knowledge from various scientific and societal bodies of knowledge." Lang et al. (2012)

lower confidence in seeking and accepting opportunities when they arise (Evans and Cvitanovic 2018; Gustafsson et al. 2020; Keller and Limaye 2020; Washbourne et al. 2020).

However, ECRs can hugely benefit from engaging with SPI, leveraging the value of their own research, building their capacity in working with policy agendas, framing policy-relevant research questions, and identifying pathways to create social change (Gustafsson et al. 2020). In this Perspective we aim to help ECRs through the use of a co-created mind-map, which can help ECRs navigate and situate themselves within SPI. It builds upon pioneering work that has been published in recent years on opportunities and challenges for ECRs engaging in SPI (Chapman et al. 2015; Evans and Cvitanovic 2018; Gustafsson et al. 2018; Gustafsson et al. 2020; Jaeger-Erben et al. 2018; Sellberg et al. 2021), hoping to help ECRs better understand their place within the SPI operating space and inspire and guide ECRs to get more involved. In the following sections we summarise a case for ECRs to join SPI, provide a description of the process of co-creating the mind-map, and explore the ways that the mind-map can help ECRs to navigate SPI.

2. Why Should ECRs Engage with SPI?

Knowledge transfer between science and policy was historically thought of as a one-way process, but this view is now changing to recognize a more complex two-way relationship (Lentsch and Weingart 2011). SPI allows for the exchange, coevolution, and joint construction of knowledge which can enrich both decision-making and/or research (van den Hove 2007). By engaging with SPI, ECR's active in the field of biodiversity and ecosystem services can learn how to make biodiversity loss and environmental challenges relevant to policy-makers, and ultimately issues upon which real-world action is taken, by linking them to issues at the forefront of the political agenda such as the economy, security, human health, and the Sustainable Development Goals, which have been endorsed by all countries (Watson 2005). ECRs can also learn to formulate research questions that are relevant to policy makers and other societal actors, improving the relevance and applicability of their work (Sarkki et al. 2014). Engaging with SPI can enhance more general ECR skills such as collating and communicating large volumes of often conflicting information, communicating scientific uncertainty, undertaking evidence reviews, and learning to engage with multiple actors and institutions (Jaeger-Erben et al. 2018; Gustafsson et al. 2020). It can be crucial for forming networks with more senior scientists, policy-makers, and fellow ECRs (Gustafsson et al. 2020).

There is much that ECRs can contribute to the SPI space. ECRs have up-to-date understanding of research topics, being actively involved in research themselves (Bull et al. 2016), are open to opportunities, less likely to be locked in to old patterns of thinking and doing (Milman et al. 2017; Haider et al. 2018; Hein et al. 2018), and are likely to be willing to have an active role in informing policy-making and advocating for transformative change (Renn 2019). As the current global crises unfold, ECRs will be highly impacted by their consequences, and might feel an ever-growing responsibility to be the problem solvers (Cumiskey et al. 2015; Jeanson et al. 2020) becoming key players in intergenerational SPI work (Gustafsson, 2018; Lim et al., 2017). ECRs are training and working during a highly digitally connected time and can bring strong communication skills, experience in public engagement, and familiarity with emerging communication and engagement technologies which can facilitate dialogue and help engage and communicate scientific findings with policy-makers and wider society (Costanza et al. 2017; Lambini and Heubach 2017; Hackenburg et al. 2019; Jeanson et al. 2020).

3. Mind-map for ECRs Navigating SPI

3.1 Developing a mind-map

The ECR-SPI mind-map draws its overall structure from Lawson and Lawson's (2013) framework for 'student engagement', the direct experience of the authors (who are all ECRs working across a wide range of geographic settings), and the insights of ECRs working in SPI who participated in a workshop at the 7th IPBES Plenary meeting in Paris, France (2019)[2]. The ECR-SPI mind-map does not seek to provide a fully comprehensive view of the experience of all ECRs but aims to give detailed qualitative insights into the perspectives of a range of ECRs active in SPI to understand how others can become more engaged.

The author team co-developed the original version of an ECR-SPI mind-map using the Lawson and Lawson (2013) framework as a skeleton to make sense of their direct experiences in SPI, complemented by key literature on the topic (as summarised in Section 2 of this Perspective). Lawson and Lawson present their original framework (focussed on secondary and post-secondary students) as the 'conceptual glue' connecting the different elements of: 'agency' (related to prior knowledge, experience) and 'environment / ecology' within which individuals were operating (in relation to peers, family, and community) to the 'organisational structures and cultures' of their institutions. The framework provides a broad, system-oriented conceptualization that includes the psychological, sociocultural, and sociological dimensions of engagement (in this context seen as the physical, cognitive, and behavioural presence in and attentiveness to spaces and processes of learning and personal development). The author team saw commonalities with the ECR-SPI context in this framework, finding it a useful tool for structuring and sharing experiences and undertaking reflective practice. The authors were particularly interested in understanding the nuanced relationship between opportunities, barriers to entry and benefits of engagement in SPI and resolved to test the utility of the mind-map for other ECRs in a small, informal workshop setting.

An informal 90-minute-long workshop with ECRs was conducted during the 7th IPBES Plenary in May 2019 (Paris, France) (detailed methodology included in supporting information). Thirty ECRs were recruited, through a social media call targeting ECRs attending the Plenary, to participate in discussions around their engagement in SPI. The group split into smaller working groups and explored two different sets of questions: (i) "Have you been engaged in SPI? If yes, in what way? If not, why not?" and (ii) What has your experience of SPI work been?". The draft mind-map categories were used as prompts during the discussions. Inductive thematic analysis was conducted on insights emerging in response to these questions and themes were mapped back on to the draft mind-map to consolidate the categories and verify its structure and scope.

With reference to the final version of the co-developed mind-map the author team hypothesised that several connected factors seemed to be critical in ECR engagement in SPI: the *environment* of ECRs (in terms of motivation, opportunities and barriers), which mediates their *acts of engagement* (in

[2] IPBES was established in 2012 as: "an independent intergovernmental body [...] to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development" and is a major SPI actor https://ipbes.net/

relation with SPIs), which then lead to various *outcomes,* ultimately feeding back into the ECR environment (Figure 1).

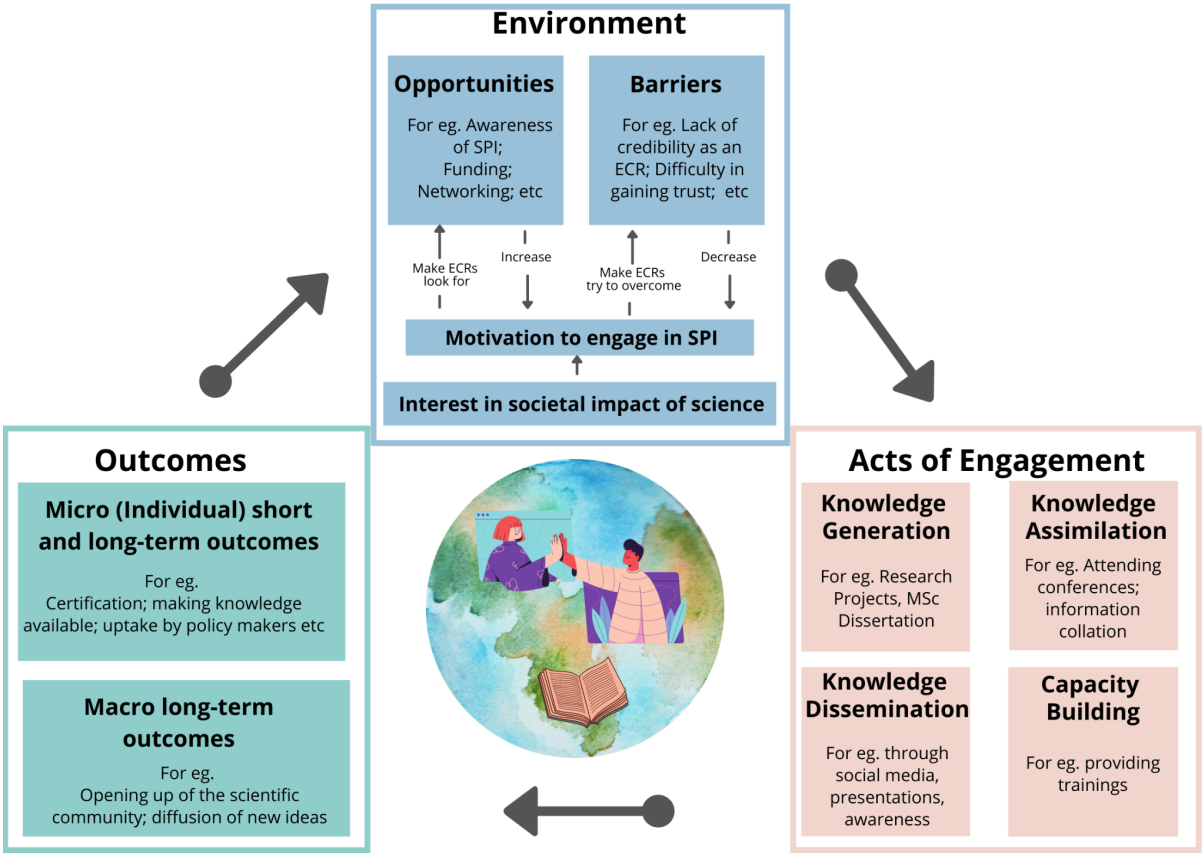

Figure. 1: Co-created ECR-SPI mind-map detailing ECR engagement with SPI. ECR engagement is illustrated as a systemic process with multiple feedbacks.

3.2 Exploring ECR experiences through the ECR-SPI mind-map

The ECR-SPI mind-map recognises that the *environment* an ECR finds themself in strongly mediates their engagement with SPI (Figure 1). *Environment* refers to both internal (e.g. personal interests and character) and external (e.g. the place of work) factors. The exercise of creating the ECR-SPI mind-map highlighted the existence of a wide range of opportunities and barriers in the immediate *environment* that, in interaction with ECRs individual motivations, influence their SPI engagement. These are explained further in Table 1, which provides concrete examples identified by the authors and workshop participants. “Motivation”, “Opportunities” and “Barriers” interact to determine ECRs’ level of access to SPI and the combination of these factors can vary with socio-cultural contexts. Motivated ECRs may choose to work in or collaborate with colleagues in environments where the contribution of research to policy-making is talked about and promoted, seek graduate programmes or internships with an SPI focus and join or establish networks of peers active in this space. When seeking to engage in SPI work, ECRs should be mindful of, but not deterred by, others’ perceptions of their experience or credibility, which may be magnified by socio-cultural factors including gender. Acknowledging and overcoming barriers and increasing real and perceived legitimacy in SPI, through increased practical experience and personal resilience, can be achieved through ac*ts of engagement* with SPI, as described in the following section.

Table 1: Examples of Environmental factors

Motivation	Opportunities	Barriers
An intrinsic interest in the societal impact of science A desire to build skills in SPI A desire to form networks with policy-makers, senior scientists and other ECR's	Exposure to a studying or working environment where the contribution of research to policy-making is talked about and promoted. Access to graduate programs or internships with a focus on SPIs. Exposure to networking opportunities related to SPIs. Such as engagement with groups of peers (e.g. ECR networks) as a stepping stone for involvement in the SPI.	Perceived lack of credibility of ECRs due to limited experience. Being young and / or having little experience in the field could hinder engagement with policy-makers. Socio-cultural barriers such as gender could influence perceptions of credibility and experience A lack of transdisciplinarity in the academic approach to SPI

A*cts of engagement* refers to the activities and roles through which ECRs can engage in SPI (Figure 1). Our work highlighted four main *'acts'* through which ECRs can engage in SPI. These are further explained in Table 2, which provides concrete examples identified by the authors and workshop participants. 'Knowledge Generation' was identified as the main way in which ECRs are currently contributing to SPI, while the other three *'acts'* (Knowledge Assimilation, 'Knowledge Dissemination' and 'Capacity Building') were noted as more marginal, or areas of potential but not current contribution. This insight echoes the situation described in much of the contemporary literature, where knowledge generation activities are the focus of many existing recommendations for ECR engagement in SPI (as described in Section 2). The ECR-SPI mind-map highlights a recognition of the value and potential attractiveness of other areas of contribution by the ECR community. Knowledge generation is understandably one of the key areas for input for all scientific stakeholders, providing research insights and expert testimony to SPI exercises, however the other '*acts'* are increasingly within the skillset of modern researchers and engaging with them can present opportunities for opening new arenas of engagement for ECRs. To improve access to these lesser cited *'acts*' ECRs might proactively learn more about the 'demand-side' for knowledge from the policy-making perspective, which could be through participation in events with a relatively low barrier to entry such as the IPBES plenaries. ECRs may develop knowledge dissemination skills by engaging with synthesis activities and being active in spaces outside of traditional research including social media. ECRs may also receive or offer peer training or otherwise engage in training that seeks to bring together different stakeholder groups. Some successful examples, such as the Early Career

Fellowship programmes offered by IPBES, already enable ECRs to work in settings where various *acts of engagement* are taking place (Gustafsson et al. 2020).

Table 2: Examples of Acts of Engagement

Knowledge Generation	Knowledge Assimilation	Knowledge Dissemination	Capacity Building
ECRs engaged in producing reports and assessments for policy needs ECR's engaged in answering research questions relevant for policy	Learning about the needs of policy-makers and how to communicate with them about their research. Collating information from a variety of different sources Evidence reviews Integrating scientific and other kinds of knowledge, including indigenous and local knowledge	Presenting results at events attended by policy-makers Synthesising research outputs for members of government / parliament Being active on social media.	Training peers or other stakeholders in SPI, or raising awareness of science-policy issues. Increasing awareness and literacy through social media engagement

The *outcomes* of these *acts of engagement* were described as ranging from "Micro" (individual and / or short-term) outcomes, to "Macro" (collective and / or long-term) outcomes (Figure 1). These are further explained in Table 3, which provides concrete examples identified by the authors and workshop participants. ECRs can personally seek to increase skills and knowledge relevant to SPI through their active engagement, leading to a range of both individual and collective outcomes. While engagements may be initially individually focussed and short-term, they can shape personal development trajectories over the long-term, be shared with peers and brought back to institutions, and ultimately lead to more 'macro' outcomes creating positive changes in the *environment* for ECRs and their colleagues.

Table 3: Examples of Outcomes

Micro (individual) Outcomes	Macro Outcomes
Increase in skills and knowledge, which can take the form of contribution to knowledge products such as: - scientific papers, - technical reports and - policy briefs. ECRs are also likely to help other stakeholders (students, NGOs, governments) increase their knowledge and skills by engaging in training activities [workshop participants mentioned their role in "bringing back" knowledge to their respective institutions.]	Diffusion of new ideas and ways of thinking Impact on the way that Academia will interact with SPI in the future Creation of a new generation of policy-savvy researchers.

One of the key benefits of the ECR-SPI mind-map is acknowledging that *environment, acts of engagement* and *outcomes* are intrinsically linked. ECRs may struggle to leverage their motivation to be involved in SPI in an *environment* where barriers outweigh opportunities. *Acts of engagement* can only be undertaken once the *environment* permits and enables. In an ideal scenario, *outcomes* follow the *acts of engagement* and nurture the *environment* in a positive feedback loop.

4. Conclusion

The authors hope that this co-created mind-map provides a useful basis for guiding ECRs through some key considerations of working in SPI and operates alongside existing recommendations to further encourage and enable engagement. In particular, we hope that ECRs can profit from the mind-map to:

- appreciate that working environments can present opportunities and barriers to engagement, which may need to be acknowledged and navigated to channel motivation;
- see opportunities to capitalise on activities related to knowledge generation, as well as seeking less obvious but no less critical opportunities to contribute to knowledge assimilation and dissemination, and capacity-building; and
- appreciate that work in SPI can help to deliver both micro- and macro-outcomes, that may help to drive positive change in the wider working environment.

The ECR-SPI mind-map has applicability as a tool for planning and process mapping as well as self-reflection and evaluation, as it increases the transparency of the complex factors dictating engagement and highlights the interactions between them. As well as an aid for individuals

navigating this space, we hope that it will be a useful tool for structuring and initiating discussions, experience sharing and peer-learning processes within ECR groups and in supporting discussion with colleagues and across organisations. We are keen to know if and how readers have used or interacted with the proposed mind-map and strongly encourage anyone interested in this space to get in touch to explore further engagements.

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Supporting Information

Methodology (detail)

Workshop at IPBES 7 Plenary

Participants were recruited through a social media call, using Facebook and Twitter (with #YESS2IPBES (referring to the Young Ecosystem Services Specialists group, which many of the authors are affiliated with) and #ipbes7 hashtags), targeting ECRs attending the Plenary.

Thirty ECRs were recruited to participate in discussions around their engagement in SPI. Participants were orally briefed on the aims of the workshop at the beginning of the session, participated voluntarily and could leave the workshop at any point. Participants were split into two smaller focus groups, seated at separate tables. There was almost equal gender representation in both groups and participants were from Europe, Africa, and Asia. The workshop was conducted with three to four facilitators and one note-taker from the author team in each group.

To establish a common understanding of SPI, we first asked each participant to share their definition of SPI. Then, we explored two different sets of questions: (i) “Have you been engaged in SPI? If yes, in what way? If not, why not?” and (ii) What has your experience of SPI work been?”. Responses were collected anonymously and stored as hand-written notes by the note-taker that could not be traced back to individuals.