

**New Zealand's Biological Heritage National Science Challenge
Scoping Panel Report****Strategic Outcome 6: Social-Ecological Resilience**

Section 1: Creating Impact

Vision and link to the Challenge mission

The Challenge's mission is to *"reverse the decline of New Zealand's biological heritage, through a national partnership to deliver step change in research innovation, globally-leading technologies, and community and sector action"*. SO6 delivers a pathway to achieve that mission by integrating ecological and social knowledge and demonstrating tangible and practical ways forward.

We recognise the limits of purely biophysical science in providing solutions to declining biological heritage. Any solutions that fail to accommodate the needs and aspirations of people, as well as the ways in which humans behave, will never succeed. The decline of NZ's biological heritage can only be reversed by changing the way in which people engage with the environment. In part, this change will involve transitions toward resource use that enhances, rather than degrades, the resilience of natural and production ecosystems and people who manage them. In part, these 'just transitions' will involve growing opportunities for people who wish to engage with environmental stewardship to begin doing so in a way that is feasible amidst their existing constraints.

We also recognise the interconnectedness of our ecosystems, such that everything we do on land or water impacts our neighbours, our landscapes, and the ability of land and water to sustain our well-being. While financial impacts are frequently considered, the impacts on people's culture, health and well-being often do not receive a fair weighting in decision making. Thus, to embrace this view of connectivity among people and environments that together comprise our landscapes and catchments, we must mature beyond policies that focus on biophysical elements of ecosystems in isolation, or that inadvertently break the long-held connections between people and the environment. Strategic Outcome 6 thus provides new opportunities for conceptual leadership and integration across systems that is essential for achieving the Challenge's mission.

Strategic Outcome 6 will focus on engaging communities, policymakers and production sectors to strengthen positive connections between people and their environments. To facilitate decision making, we will generate robust approaches to measuring the impacts of environmental management and policies on well-being, including cultural values, and provide realistic pathways toward a more resilient future. This will require us to understand and develop rigorous measures of past, present and potential future connections of people to the environment, and the positive or negative impacts of policies and management on these connections.

We acknowledge the enormous efforts by thousands of New Zealanders to reverse the decline in our biological heritage, but also recognise the challenges they face in connecting with one another, in scaling up and leveraging their current effort, and in overcoming economic, legislative and organisational barriers to more sustainable and culturally-appropriate environmental stewardship.

We also acknowledge the weight of the Waitangi Tribunal ruling on Wai262: Ko Aotearoa Tēnei, and the significant work required to give effect to its recommendations. The first step in this process will be to break the self-reinforcing processes that restrict the relationship tangata whenua have with their environment. Our outcome goals reflect these grand and urgent challenges and provide a plan for reconnecting people with the environment in a way that will enhance our biological and biocultural heritage.

2024 Goals

A key focus across all our goals will be on understanding and demonstrating how trade-offs in values occur spatially or across systems, over what spatial scales the values are obtained, and how this influences practical pathways to implementation. By 2024 we will have:

1. Greater understanding of the many ways in which connections between people and nature influence resilience.

Within this broader goal, we have the following specific objectives:

- (A) Synthesise existing knowledge, understanding and approaches to defining and communicating how social-ecological linkages nurture resilient ecosystems.
- (B) Create knowledge that describes spatial and temporal diversity in the relationships between people and nature.

2. More meaningful ways to evaluate the non-market values of the environment to people.

Within our broader goal, we have the following specific objectives:

- (A) Identify, quantify and connect non-market benefits of nature that under-pin the relationships between people and nature.
- (B) Determine how these non-market values are degraded or enhanced in accordance with changes in biological diversity.

Within a four-year framework, we see the completion of case studies as a realistic goal, which can then be used as a starting point from which to begin conversations in other regions.

3. Diverse, successful, practical pathways for those wanting to regenerate ecosystems and culture.

Within this broader goal, we have the following specific objectives:

- (A) Create and operate an adaptive management network (AMN) to connect and enhance the success of local regeneration efforts in Aotearoa New Zealand. The creation and growth of an effective network will be informed by knowledge generated and synthesised in Goal 1, and be used to disseminate knowledge on non-monetary values from Goal 2. Business as usual involves small local networks, or disconnected activities in a single region (e.g. many restoration groups operating in isolation within the same catchment), and our aim is to connect and scale up these efforts.
- (B) Create knowledge that will clarify pathways and remove barriers for enhanced restoration success. This will build from the synthesis in 1B. We will focus on identifying barriers and past failures and what determines how much value is derived from investment, which can then be used to inform future attempts. Use AMN to disseminate this knowledge.
- (C) Contribute to the co-development of exemplar restoration projects that showcase successful regeneration of mātauranga and bioheritage, in native species enterprises and urban environments.

Beneficiaries

We foresee a wide range of beneficiaries from the proposed goals. First and foremost, SO6 identifies rangatahi and future generations as the ultimate beneficiaries of outcomes. To prepare for the future, we seek a greater understanding of social-ecological dynamics, informed by knowledge of past and

current relationships between people and nature (Goal 1). Beneficiaries thus include both holders and seekers of knowledge, who together enable a greater understanding.

Where possible, we will build on existing partnerships with relevant Māori groups. For example, established relationships with Te Rūnanga o Ngāi Tahu and the Hauraki Collective will be further developed and strengthened. Both these iwi representative groups have already considered the goals of SO6, and approved engagement with the BHNSC around relevant opportunities in their regions. New relationships and opportunities with other iwi will be explored (e.g. Tūhoe). Iwi/hapū hold and seek ways for greater knowledge capacity and building pathways for reconnecting tangata whenua with whenua, which are foci for all three SO6 goals.

Many organisations need to better understand the connection between our biological heritage and a diverse suite of well-being outcomes. Goal 2 will equip multiple organisations with the tools they need to effectively evaluate and demonstrate the positive or negative impacts of environmental decisions and changes on multiple dimensions of cultural, social and physical well-being. Specific beneficiaries will be New Zealand communities that may be affected by environmental change; local residents (urban and rural), businesses, iwi, hapū and whānau and/or Māori community, rūnanga or marae-based trusts. With these groups we will develop and test new values and well-being assessment tools and approaches, to complement existing tools (e.g. Mauriometer, Te Whare Tapa Whā, Te Pae Māhutonga) in locations where significant positive or negative socio-ecological change is projected to occur in the medium term. Relevant plans, policies and programmes can thus benefit immediately from the incorporation of non-market values. Partner organisations will be central to the delivery of (and beneficiaries of) these outcomes; for example, regional councils, Predator Free New Zealand, DOC, and Māori groups mentioned above. Additionally, community groups (e.g. Environmental Defence Society, private philanthropists, Federated Farmers, New Zealand Deerstalkers Association, Forest & Bird) will benefit from a non-monetary evidence base to strengthen their arguments to protect the environment.

New Zealand needs to address the tension between economic production and bioheritage. As one pathway to overcome this tradeoff, Goal 3 will launch or research various exemplar restoration projects that mix human use with environmental resilience. Beneficiaries will involve: (a) iwi/hapū/whānau with interests in customary harvests of flora and fauna or approaches to retain knowledge in a new social context, (b) native species enterprises where commercial activities can be combined with bioheritage regeneration, and (c) individuals and groups involved in regenerating urban or production-sector bioheritage.

Regional and central government entities (e.g. MfE, MPI, DOC, MOH, StatsNZ, MFAT, TPK) all benefit from improved articulation of the demographic variability in the way people view, value and interact with nature. For example, identification of the positive drivers that lead to resilient social-ecological systems provides a focus for prioritisation of restoration investments. Likewise, they will benefit from significantly improved tools to evaluate values beyond the current economic paradigms, enabling them to better reflect their constituent's needs. In some cases, these entities have tenuous relationships with landowners, and the role of the NZBH Challenge as an 'honest broker' and facilitator of connections (e.g. in Goal 3) will promote more productive conversations.

Finally, our large-scale adaptive management network (AMN) in Goal 3 will target those already wanting to engage in regenerating bioheritage. It will provide a far-reaching platform for individuals or organisations looking to exchange ideas and information on successful and practical pathways for regenerating ecosystems and culture (bioheritage), or to propagate collective action. Thus, beneficiaries could be very widespread, but will include farmers and rural communities, Māori land trusts, smaller district and regional councils in particular, and the many local landcare and catchment care groups around the country. Specific examples of national organisations that will benefit from the AMN include: Living Water, QEII, Dairy NZ, Beef & Lamb NZ, Hort NZ, and the Federation of Māori Agribusiness. More generally, SO6 will provide researchers with a mechanism for reaching a wide

range of New Zealanders, and for promoting the uptake of research findings on restoration or land management.

Delivery pathways

Goal 1: A greater understanding of the many ways in which connections between people and nature influence resilience.

Goal 1 provides fundamental new knowledge and knowledge synthesis, to support Goals 2 and 3 and other Strategic Outcomes in the Challenge, related to (i) defining and communicating how social-ecological linkages nurture resilient ecosystems, (ii) describing spatial and temporal diversity in the relationships between people and nature, and (iii) exploring frameworks and methods for linking different scales of social-ecological connections. Although Goal 1 lies more at the discovery end of the innovation pathway (with a longer time horizon to impact), impact will occur by helping inform investments within the Challenge and with partnering organisations. Goal 1 will also inform the design and expansion of the Adaptive Management Network in Goal 3 (a delivery pathway for this knowledge), by building from the literature on collective action and management of common resources. Storytelling is one mode of communication that will be explored in research methods and used to disseminate results. 'Show me examples' via multiple media is seen as a means to achieve impact via shared learning and ultimately behavioural change.

Goal 1 will include at least three think pieces which will explore the role of technology in shaping social-ecological systems, changing attitudes towards valued exotic species and their place in regenerating biological heritage, and the role of theoretical and cultural frameworks for understanding how the emergent properties of social-ecological systems could enable or prevent bioheritage regeneration. Think pieces are relatively small investments that build off a synthesis of existing knowledge and provide an opportunity to harness new ideas, bring together teams with common interests, and identify areas of future focus and impact. They are ideally led by early-career researchers, and thus provide capability and capacity development.

Goal 2: More meaningful ways to evaluate the non-market values of the environment to people.

We anticipate multiple delivery pathways, generated through case studies across contrasting systems, and that are manifested over the short- (i.e. before 2024) and long-term (e.g. refined decision-making or policy, particularly around Treaty 'issues'). Impact will, in part, be achieved through case studies focused on places undergoing, or preparing to undergo, significant social and ecological transformation. Opportunities to evaluate changes in non-market values include places where entire communities are mobilising for biodiversity outcomes through Predator Free New Zealand, our capital city which is one of the only cities in the world where native bird biodiversity is on the rise, not the decline, and, unique, iwi-led initiatives to transform the ecological health of whole regions. In contrast, proposed large-scale developments also offer the opportunity to examine how biological, social and cultural well-being might be eroded by ongoing or proposed impacts.

Case-studies will provide a focus for the development and testing of tools and best-practice guidelines for quantifying the non-market values of the environment to people. Long-term impact will occur once (a) non-market values of the environment to people are consistently identified for appropriately scaled groups and (b) these non-market values are implemented and prioritised in restoration plans, policy, treaty negotiation processes, and decision-making frameworks. Thus, providing the tools to amplify sectors with little voice in current decision-making arenas. Ultimately, impact will be created through the due prominence that non-market values will gain in decision making processes, and all New Zealanders will benefit from this. Through our iwi partners and researchers in SO2 we focus on working with communities under stress (potentially linking to Healthier Lives NSC), and with SO7 we will explore relationships with the Waitangi Tribunal and the NZ

Environment Court system as means for prioritising non-market values in the legal decision-making process.

The breadth of Goal 2 means that delivery must specifically focus on high impact areas. These will be determined in part through the process outlined in Goal 1, but may include for example, physical, social and cultural values of the environment to the local community. One component that can proceed almost immediately is the development, with mana whenua, of tools and techniques to map and articulate interconnected values (i.e. through te Ao Māori lens), and thereby demonstrate pathways of indirect impact following change. This is crucial for beginning to demonstrate the full repercussions of decisions, and can thus improve upon current decision-making processes, which typically fail to quantify and articulate the non-monetised values that society places on the environment. Section 32(2)(b) of the RMA requires costs and benefits to be quantified "if practicable", and our values mapping approach will make this quantification more practicable.

For the iwi groups that have already shown interest as exemplars, pathways to impact would include: (i) guiding priorities and schedules of action for iwi-led restoration initiatives; (ii) cultural redress under Treaty of Waitangi settlements (e.g. in Agreements in Principle, Deed of Settlements and by post-settlement governance entities); (iii) reclassification of land that accounts for te Ao Māori-centric management; (iv) wānanga with tohunga or kaitiaki to disseminate knowledge and help regenerate connections between people and the environment; (v) iwi management plans that guide future direction and action for rūnanga, developers, and local and territorial authorities; (vi) community summits, to allow for community discussion and buy-in; (vii) and increased levels of youth engagement with the environment.

Local and central government also need measures of the impact of alternative decisions on Māori, and this work will be a step towards giving added weight to Māori values in decision making. Regional and central government entities, and Crown-authorized agents such as Fish & Game, represent the other governance partner in the treaty (the Crown), and will be instrumental in implementing outcomes from our research. Delivery of impact within te Ao Māori space will require alignment of outcomes and pathways from SO2 and SO7, and Goal 2 will provide an approach to quantify impacts of environmental changes on Māori (as is needed for invasions in SO3). The scorecard for how people interact with the environment (SO1) will both benefit from our Goals 1 and 2 and also provide a pathway to impact.

For community groups and iwi, shorter-term impact pathways will include improved restoration management plans that give effect to identified values and well-being benefits, and increased ability to secure revenue (including from health and well-being-focused funds) by demonstrating wider benefits of restoration activities. Longer-term benefits include recognition and prioritisation of these values and benefits in district and regional plans, and a rebalancing of market and non-market values under the RMA. This work will also provide philanthropists and land-owners with clear indication of what matters to the local community in which they are about to engage (e.g. Cape Kidnappers Restoration Trust).

Goal 3: Diverse, successful, practical pathways for those wanting to regenerate ecosystems and culture.

Goal 3 will convene a large-scale adaptive management network (AMN) to connect those involved in bioheritage regeneration, and enable networking and information sharing to underpin successful regeneration. It will be impactful by providing a platform and framework for: (1) regeneration champions to influence others, (2) workshops and field days on regeneration, (3) think tanks for tool demonstration and sharing, (4) a vehicle for the dissemination of exemplars and demonstration sites, (5) hosting of regeneration databases (e.g. to connect community restoration groups), (6) a source of information and activity to identify and solve regulatory issues, (7) identification of people and place opportunities (e.g. for restoration volunteer groups), and (8) a hub for the dissemination of science

information. A key pathway to success for the AMN will be to build relationships and trust between the many entities and groups of people involved in restoration. The formation of these working relationships and associated communication is essential for progress. Thus, the AMN is the single most important delivery pathway, and is critical for Goal 3. Because the AMN will be informed by Goal 1, it will constitute a delivery pathway for that knowledge and the methods/findings from Goal 2.

Exemplars built around 'local' AMN, which reflect critical gaps in regeneration efforts, will be supported. These will be small-scale, low-cost efforts primarily involving seed funding for human resources to stimulate demonstration sites or examples of restoration success in areas where current efforts are not reaching their potential, or to conduct economic analyses of alternative management approaches. Our scoping process revealed numerous individuals and organisations that would like to manage their land more sustainably, but face economic or legislative barriers to doing so. Others have attempted restoration actions but not achieved the desired success.

High priority areas within this kaupapa include regeneration of mahinga kai, native species enterprises where commercial activities can be combined with bioheritage regeneration, methods for restoring knowledge that has been lost through restricted engagement of mana whenua with the environment, and urban bioheritage.

To address this national opportunity, Goal 3 will (A) prepare a synthesis of reasons for restoration failures and barriers to restoration success. This reflects evidence that restoration often fails, especially in freshwater ecosystems, because it is in the wrong place or sequence, or barriers (e.g. physical or biological legacies or multiple stressors) have not been addressed. Thus, an important pathway to regeneration success is identifying ways to overcome these challenges. Identification of legislative and technical barriers and ways to overcome economic barriers will also be a priority, and will have a pathway to impact via SO7.

Second, (B) how to effectively scale local AMN networks to have whole catchment or landscape-scale impacts will be evaluated. This will identify ways that the management network can be adapted and scaled such that locally-derived information has widespread benefit and is quickly implemented. This work will link with Goal 1 and test assumptions about social connectivity, the flow of information and its use in local contexts to incrementally improve (i.e. 'adapt') the AMN in real time. Thus, this study will support impact by understanding how the AMN works.

Third, (C) case studies will initially address known critical knowledge gaps regarding harvestable native species and the management of resilient (including genetically), sustainable populations. In addition, retaining contestable seed funding for ongoing study of regeneration roadblocks will be useful. Studies in all three areas above (A-C) are lower priority than the AMN itself, but are nevertheless important for underpinning its effectiveness. The Challenge is unlikely to be able to fund all of these studies, but should look to partner or provide co-funding for studies or projects that are aligned to these goals.

Risks

We identify three key areas of risk. These are (a) ecological risks (b) social and cultural risks and (c) economic derailment risks.

Ecological risks include failure to understand obstacles to succession, such as hysteresis, legacy effects, alternative stable states, introduction of harmful species, and resistance to interventions. Ecological risks also include restoration work occurring without adequate knowledge of the system, thereby prohibiting desired outcomes (e.g. forest-obligate bird restoration attempted in forest-depauperate areas). In part, Goal 3 addresses this latter risk (which is a risk of restoration, rather than SO6 specifically), and unknown obstacles provide avenues for new discovery research.

Social and cultural risks include a failure of co-design, such that Māori and Pākehā alike perceive being told who they are and what they should value, which would lead to disengagement from the process. Methodological risks will arise when researchers apply a 'lens' to values when aggregating them, based on their own distinct world views. Cultural background of researchers conducting the work is important for mitigating this risk, as are strong existing relationships based on mutual trust. Discordance *within* groups about important values poses a risk to the process: this risk is likely to increase with group size. Trade-offs between values may result from discordance in values (e.g. herbivory by valued hunting animals reducing habitat for valued bird species) and will need to be resolved within groups and with stakeholders. Values may also become discordant by shifts of priorities over time within communities. The Adaptive Management Network in Goal 3 depends on existing local networks and alliances seeing value in connecting, and showing willingness to share data where appropriate.

Economic derailment risks will emerge through underinvestment and truncated investment leading to long-term failure to thrive after early impact. Focusing too narrowly on non-market values may lead to the exclusion of some non-market values that accrue from market values. An example of this is profitable economic activities leading to the revitalisation of communities through job provision and cultural opportunities (i.e. effects on indirect non-market values).

Finally, there is a risk of failing to take account of the emergent social-ecological properties of systems. For example, negative feedback loops in the relationships between people and nature, driven by social structure legacies that are unable to adapt at the same time scales of change in key economic or technological drivers. Discordance or asynchrony of key elements could lead to hysteresis and failure at meaningful timeframes in the regeneration of biological heritage. A priority of Goal 1 will be to identify these risks, which in turn may provide opportunities for new research.

Communications and relationship management

Māori partnerships

All three goals require partnership with iwi, and these relationships will be managed with Cultural Safety Agreements between researchers and tangata whenua to guide obligations to each other. Importantly, these agreements provide criteria around Free Prior and Informed Consent, intellectual property and knowledge ownership and information release. Where appropriate, Memoranda of Understanding will channel directorship funding to iwi to cover employment of project co-ordinators and researchers, kaumātua and advisory group meeting fees, the hosting of hui and wānanga, youth capacity-building activities, conference attendance, and hardware and software costs. Regular (biannual or quarterly) meetings will be held with relevant iwi representatives and Crown agencies to review the research approach, outcomes, and issues.

For Goal Two, six-monthly meetings between BHNSC, iwi researchers and *Te Rakau Tārake* (our multi-iwi research group) members will report on progress towards conceptualising te Ao Māori values within a socio-ecological context, and innovative strategies for engaging cultural values in policy and catalysing action. For Goal Three, the portion of the Adaptive Management Network that refers to customary harvests will be led by iwi to ensure information and communication remains relevant and engaging to the iwi, hapū and whānau involved.

The most appropriate communication channels to use with iwi, hapū and whānau have preliminarily been identified as community-specific newsletters, presentations and visits, wānanga, media releases, podcasts, social media releases and/or documentaries. Efforts will be made early in the investment to identify bioheritage 'conversations' that are already happening in relevant communities, such as local pest control groups. Communications between iwi and government agencies must be regular for this line of work to maintain trust and increase the likelihood of a successful partnership. The form of these communications will need to be determined by the key individuals involved in the project.

Government organisations

Central, regional and local government bodies will need to be engaged at different stages in the five-year investment plan. Key beneficiaries identified include MfE; MBIE; MPI; DOC; MoH; StatsNZ; MFAT; Te Puni Kōkiri; Overseas Investment Office; Waitangi Tribunal. Key contacts within these organisations would become important stakeholders, partners or members of research groups and organisations developed within SO6. For example, members of the Ministry of Health would need to be enlisted to assist with Goal 2. It is important that the goals of SO6 align with, and do not replicate, those of pre-existing governmental plans in the areas which overlap. With the help of SO7 (Governance and Policy), we aim to disseminate research results from SO6 to governing bodies using policy briefs. This will help change relevant policies and increase the impact of our research.

Non-government organisations

Fish & Game, Forest & Bird and other independent organisations (e.g. Zealandia, NEXT Foundation, TerraNature, Queen Elizabeth II National Trust, NZ Landcare Trust, Working Waters Trust) each have their own ethos when it comes to productive and natural landscapes. They also have significant support in an array of communities, and it would be beneficial for us to both acknowledge their values as we develop our research programmes and disseminate the resulting information to them. Often the most effective way to reach these wider (national) communities is through their own regular magazine/newsletter and social media. Events held by NGOs are a good opportunity to reach a more local audience and would be particularly relevant to Goal 1.

Rural and urban communities

For Goal 3, strong relationships need to be built with farmers, farming and other business networks. This will most effectively be done via existing farming channels such as newspapers, radio and social media. Champions from trusted farming cooperatives such as DairyNZ and Beef + Lamb New Zealand will need to be integral partners of this workstream if we are to gain the trust of rural communities. The Sustainable Business Network is also a point of contact for developing the Adaptive Management Network.

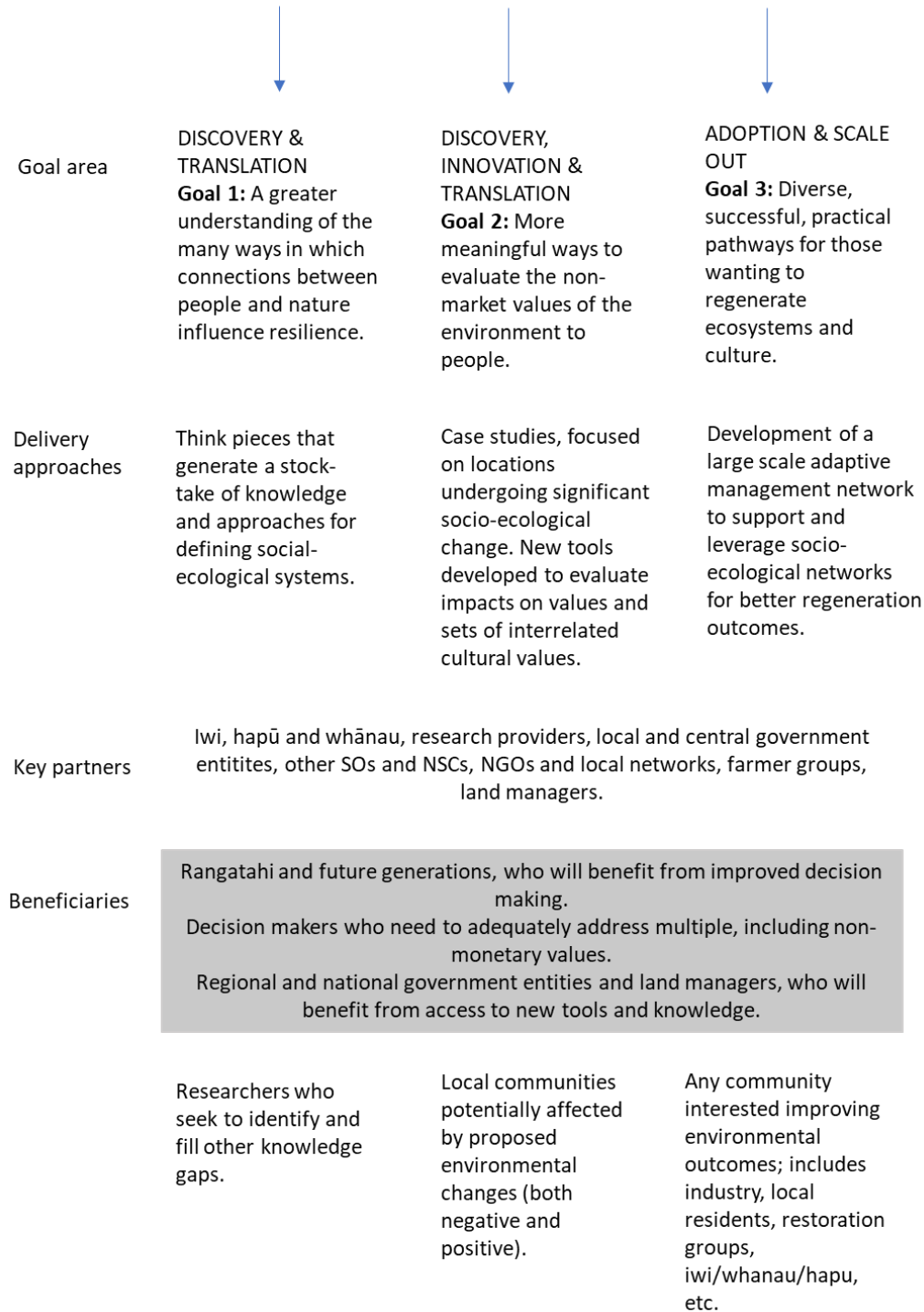
The AMN could also be taken to urban communities through pre-existing networks such as schools and recreational clubs. This would increase awareness of relevant issues, help to implement any urban-based recommendations that are produced from the research, and help to bridge the urban/rural divide.

All communities

Storytelling is an important communication tool for all three goals of SO6. As recommended by the Scoping Communications Team, what makes a good story is defined by the audience for whom it is intended. This means we need to identify what the target audience values before shaping the story. Storytelling can be used to inform the wider public of what is happening within the projects, as well as convey history, viewpoints and connections to the environment held within different SO6 parties. Specifically, whenever projects are being co-designed we must ensure effective translation between designer parties, so they have the same shared understanding of the project. We acknowledge that it might be more effective to enlist community champions to tell these stories instead of us – to build trust in the community and ensure the message is being spoken in the appropriate 'language'.

SO6 Summary overview

SO6: Social-ecological linkages for land and water ecosystem resilience



Section 2: Incentivising Investment

Essential activities

Our outcome goals are deliberately aspirational but will contribute to a transformational change in regenerating Aotearoa's biological heritage. By 2024 we plan to have achieved exemplars or proofs of concept for each goal, but the Challenge funding will be used to align with and augment existing effort, and ideally to attract additional funding for greater impact. Below we outline the essential activities for each goal, within the broader context of existing effort and potential additional work. Unless otherwise stated, the existing effort has been mapped during our scoping process, but has not committed formally to alignment with SO6. We use the abbreviation **RP** to indicate components that are ready to proceed immediately.

Goal 1: A greater understanding of the many ways in which connections between people and nature influence resilience.

The ways in which people interact with their environments, whether they be mana whenua, farmers, or urban volunteers, is the greatest determinant of the future of ecosystems. Although considerable work has explored the biophysical properties of ecosystems that make them resilient, less is understood about how humans and their complex social, economic and cultural systems can improve resilience or degrade ecosystems in ways that make them resistant to restoration attempts.

Existing effort

At the Discovery end of the innovation pathway, some NZBH Tranche 1 projects (e.g. 3.1 and 3.2) have begun to explore these questions, for example showing how land management for high productivity may keep systems close to tipping points, or how legislative barriers to mana whenua engaging with their environment can create feedbacks that reduce the effectiveness of environmental management in the long term. Positioned more around innovation and translation, the MBIE-funded People, Cities and Nature project (led by Bruce Clarkson, University of Waikato) contributes to this goal area, including the evaluation of how people connect to nature through, for example, backyard citizen science or predator trapping. SO6-aligned work, through the Victoria University of Wellington/Zealandia project, is examining how businesses perceive their connection to nature, and how this is expressed by their behaviours. In addition to informing Goal 1, these linkages with business provide an avenue for quantifying non-monetary impacts of business decisions (Goal 2).

Essential activities

Goal 1 will begin with a stock take of knowledge on social-ecological (people and nature) linkages from two world views. From a Western science framework, a stock take could involve literature review and synthesis, whereas a stock take from a Māori worldview could involve literature review, semi-structured interviews and participatory research. This will be a pivotal start in increasing our understanding of the link between people and nature and identifying avenues for focused effort to regenerate biological and cultural heritage. This discovery phase needs investment from current thought leaders (both national and international) and includes NZ-specific questions such as:

- What are the key drivers of social-ecological linkages for Māori and non-Māori?
- What are the spatial and temporal patterns in social-ecological linkages that lead to positive outcomes for biological and cultural heritage?
- What is the role of technology in understanding social-ecological linkages and shifting behaviours?

The typically location-specific (place-based and place-attached) nature of human-environment interactions, combined with the unique bicultural context in Aotearoa, means that many of these questions must be asked within a specifically NZ context. Yet, we can learn from conceptual and analytical frameworks developed elsewhere (e.g. by Elinor Ostrom, the Stockholm Resilience Centre),

and both NZ and the Challenge have an opportunity to provide international leadership in the science and supporting practice of environmental engagement by indigenous peoples.

It is frequently assumed that increased connection (or reconnection) between people and nature nurtures resilient ecosystems. Yet examples exist to the contrary, and some undesirable ecosystems (e.g. eutrophied lakes) can be resilient (this was the focus for Tranche 1 project 3.4). Goal 1 will seek generalities regarding the conditions under which social-ecological connections lead to adverse outcomes. The relationships between people and place are most often described from a personal perspective and before we can regenerate social-ecological linkages at a systems level, we must understand how to scale personal relationships to a community level.

Translating and scaling out our knowledge requires:

- Analysis of the effectiveness of different methods (including technology, storytelling) for understanding and communicating human-environment linkages.
- Exploring (and potentially developing) frameworks to support the scaling of understandings of social-ecological linkages among different groups, which is critical for engendering the empathy needed for successful collaborative processes.
- Meta-analysis of case studies of restoration success and failures to identify the ways people (re)connect with nature as well as potential social-ecological pathways and barriers to regeneration of biological and cultural heritage (this will link to Goal 3). **RP**

Goal 2: More meaningful ways to evaluate the non-market values of the environment to people.

There is no question that human survival depends on functioning natural and production ecosystems. This notion has been formalised within the ecosystem services framework, which seeks to measure, and in some cases place a dollar value on, the value of nature to humans. Such knowledge is needed, because degradation can reduce the capacity of ecosystems to deliver services, and this cost is often externalised in industry or weighted poorly in policy.

Existing effort

While considerable effort, nationally and internationally, has demonstrated how many ecosystem services respond to environmental change, others remain poorly described. Within NZ, a recent meta-analysis of land use impacts on ecosystem services found knowledge gaps pertaining to cultural values. Work on cultural ecosystem services (by Manaaki Whenua – Landcare Research) has revealed knowledge and provided a platform for understanding key values within a specific iwi context. This discovery work will be leveraged to facilitate work in the Innovation/Translation space, which will connect these values with each other and with components of the environment, and thereby lead to tools that could enable indirect impacts of policy on a range of Māori values to be demonstrated and recognised. Additionally, although ecosystem services underpin well-being by definition, it is less clear how specific components of the environment (e.g. reserves) or specific activities (e.g. engaging in restoration planting) impact human physical or mental health and well-being. The MBIE-funded People, Cities and Nature project has been exploring the relationship between culture and environment-based preferences. In terms of health and well-being more generally, there is a growing demand to understand these values, for example from central government, and conservation organisations seeking well-being metrics with which to leverage corporate funding. Manaaki Whenua and DOC are currently working in this space, and MoH is funding work to connect physical health and activity outcomes with natural spaces. Furthermore, the Zealandia Centre for People and Nature is currently focused on evaluating well-being outcomes from the natural environment. Sustainable Seas NSC 'Theme 1' explores how effects on marine ecosystems influence social and cultural values, complementing our efforts. We have already begun linking our efforts through a cross-Challenge workshop and propose ongoing collaboration.

Essential activities

Goal 2 aims to unite existing efforts and develop effective tools for evaluation of non-market values through analysis of past, predicted or potential change in social-ecological systems. These pieces of work will require:

- Think pieces/post-hoc analysis to identify key values and well-being outcomes following regional-scale environmental change, in order to focus this work on areas that can create more immediate impact. **RP**
- Translation of these findings, through identification or development of practical methods that can be used to evaluate case study systems for the values and outcomes identified above. This will involve desktop projects and synthesis of international examples.
- Evaluation of the methods developed in real case-study settings. The multiple dimensions of this work are likely to require qualitative and social science approaches, as well as public health epidemiological style analyses at a large scale.
- Collaboration with regional councils and other regulating entities to identify pathways for implementation of emerging methods.

Development of specific cultural values approaches (**RP**) will proceed with the following activities:

- Identification and selection of case studies where co-design and stakeholder engagement processes will be followed as outlined under Essential Partnerships below. A key criterion for selecting these case studies will be strong, existing relationships and mana whenua interested in co-development of the mahi.
- Dialogue processes such as semi-structured interviews, context-specific wānanga (or workshops) and on-the-land experiences will be used to explore the range of non-market values that kaumātua, kaitiaki, tangata tiaki, mana whenua have with specific ecosystems, biodiversity and/or locations.
- Values mapping: Non-market values will be mapped by BHNSC researchers and iwi researchers and/or kaitiaki to the transcribed narrative from dialogue activities (e.g. interviews, wānanga, workshops).
- Network analysis: We will construct an integrated social-ecological 'multilayer' network to investigate how the values (social nodes) are directly and, importantly, indirectly, connected to ecological nodes (species, ecosystem services, types of habitat).
- Capacity building opportunities: Opportunities for two-way learning between tangata whenua and researchers will be in place from the outset.

These value networks can assist regional and district councils to consider indirect impacts on Māori values in management plans and consent processes. They could also assist treaty negotiators to inform the cultural redress process within Treaty of Waitangi settlement, or be incorporated into NZ's environmental reporting by MfE, a need which they have identified.

Goal 3: Diverse, successful, practical pathways for those wanting to regenerate ecosystems and culture.

Adaptive management of the environment requires the accumulation of information across a range of scales. It thus benefits from multiple knowledge systems and a range of ways of interacting with the environment. Yet, coordinated, collaborative management of catchments or larger areas requires trust among parties and access to quality information, which may or may not exist. Goal 3 thus has two main foci. First, it is necessary to identify pathways to more sustainable land management approaches, which can overcome economic, social, legislative or environmental barriers to adoption or success. Second, the role of the Challenge as an 'honest broker' can be used to facilitate the extension and connection of local networks, and thereby improve access to data collected at fine resolution and to

information on regeneration pathways. Goal 3 will therefore scale up local efforts to adaptively manage the environment.

Existing efforts

There are several successful models for environmental management networks, including Living Water (DOC - Fonterra partnership), who work with UC, Cawthron and others in various catchments around the country. Numerous regional, catchment- or landscape-scale projects across New Zealand, which have various objectives associated to restoration, reconnection, and management involve collaborative networks (e.g. The Pukaha to Palliser Alliance, Predator Free Wellington, the Taranaki Maunga project, Kotahitanga mō te Taiao). A continuation of Tranche 1 project 3.3 (UC & AUT) involves the first stage of a website for farmer information on the value and enhancement of biodiversity on farmland, and completion/extension of this website would be an obvious place for early investment. In terms of practical regeneration pathways, Goal 3 will focus on one case study as a proof of concept for 2024, but this could leverage from existing work to develop and/or identify successful restoration approaches and learn from unsuccessful approaches (e.g. work by Dairy NZ, Our Land and Water first wave, NZBH Tranche 1 Projects 3.4, 1.4, a NIWA Endeavour fund project, DOC, AUT). The Department of Conservation, in partnership with Morphum Environmental and Zealandia, is also examining new dimensions and approaches through which businesses can enact environmental stewardship. Within production systems, the OLW NSC 'Pohewa Pae Tawhiti (Visualising Horizons)' project focuses on a tool to visualise the impact of different land use activities on multiple well-beings. The 'Land-use management actions record project' in OLW NSC aims to develop a national record of sustainable land-use actions to improve water quality and restore catchments and host it online via LAWA. Our work will complement this by exploring the enablers and drivers of success, and/or assess non-market outcomes and we propose further exploring potential cross-Challenge collaboration.

Essential Activities

Goal 3 will enable land managers to achieve greater success in restoring bioheritage by providing access to information, through the creation of an adaptive management network (AMN). The AMN will connect practitioners and arm them with information likely to enhance the success of their efforts. This work sits at the Translation to Adoption and Scale-out end of the innovation pathway, but also provides the framework for discovery, invention and innovation to be moved quickly to practitioners. Such networks have been used fruitfully for biosecurity in Australia and by the Environmental Protection Agency in the US (with the latter providing useful insights into how social and environmental science can be united to generate solutions-focused research). Investment will likely focus on human resourcing and data infrastructure. This work will require:

- Communication with existing similar initiatives, such as Living Water, the Canterbury Waterway Rehabilitation Experiment (CAREX), The Pukaha to Palliser Alliance, and the farmer networks of Tranche 1 project 3.3, to assemble a national AMN from existing local networks, expanding to fill gaps and increase coverage, identify needs, and provide knowledge infrastructure.
- The networks and human resources in place for Tranche 1 project 3.3 in terrestrial systems and the CAREX and Living Water efforts in aquatic systems could be combined into a central effort to make early progress on a regeneration network. That would involve centralisation of a new restoration website, co-ordination of resources and information, and the identification of current local champions within those projects. **RP.**
- Identification of leaders and champions to participate and build trust in the AMN through experience and track record in order to get stakeholder buy-in.
- Facilitation of local communities to access funding, by giving advice on sources and application strategies, and to leverage collective action (e.g. through purchasing power or access to volunteer labour).

In addition to the AMN, Goal 3 will build the evidence base for steps in diverse, successful and practical bioheritage regeneration pathways by producing new knowledge that better reveals the reasons for restoration failures and barriers to restoration success, and increases the visibility of success stories. The failure of the 'Field of Dreams' strategy (i.e. if you build or improve habitat, previously excluded communities will return) is well known, but lack of understanding of the many reasons for 'why' it fails still hinders restoration success. The work will:

- Test key assumptions and review the evidence for particular strategies in New Zealand landscape contexts, thereby zeroing in on solutions for local problems ('Innovation' in the pathway).
- Improve knowledge of the biological, physical and social issues that limit widespread catchment- and landscape-scale improvements, despite modest restoration success sometimes occurring in small-scale local contexts ('Adoption and Scale-out').
- Address key knowledge gaps about how to maximise the resilience of populations for sustainable harvesting or those undergoing regeneration (e.g. a Tranche 1 project has looked at this within the context of translocation of aquatic species, including native species being harvested commercially).
- Use regeneration exemplars in underrepresented areas, including regenerating harvestable flora and fauna, native species enterprises, and urban bioheritage, to inform the AMN. These are necessary to fill gaps in current restoration and ensure that AMN activities are grounded and have practical examples to champion.

Essential partnerships and relationships

Partnerships based on trust and reciprocity will be developed with our iwi-based partners. Whilst these partnerships may be implemented at an institutional level, they will rely heavily on the personal relationships that researchers hold with representatives within the iwi groups. As part of this partnership process, working groups will be established within the iwi organisations to co-design and facilitate the research. This process will be underpinned by Terms of Reference contained within Cultural Safety Agreements. Previous research with some iwi has already been conducted and delivered under such agreements, but it will be important to revisit the conditions and obligations on both parties to ensure they remain relevant. The facilitation of partnerships between iwi will be key. It is our intent that a multi-iwi research group is established to act as a 'Think-Tank' for conceptualising cultural values and how they intertwine to strengthen both biological and cultural outcomes, as well as acting as a conduit for the dissemination, uptake and implementation of ideas and findings. This group is provisionally named *Te Rakau Tārake* - The Imperial Tree; a traditional name given to a significant tree much visited by culturally significant and prestigious birds like the kererū, the kākā, the kōkō (tūī) and pihipihi.

We will endeavour to establish partnerships with other Crown organisations through our iwi partners. This recognises the mana of the iwi with which we engage and uses the process of mana motuhake that contributes towards tino rangatiratanga. Agreements and conditions for engaging Crown entities will be guided by the iwi. For iwi that have settled their claims, it is likely that partnership and engagement principles with Crown organisations will already exist, therefore we will align ourselves to those collaborations. Partnerships with wider stakeholder groups will be managed on a case-by-case basis and brought in under the umbrella of partnership with the iwi. It will be important that the stakeholders develop their primary partnerships with the iwi, supported indirectly by the researchers, if that is required. Our research methodology will be assessed and approved under a Social Ethics Terms of Reference defined by the different research institutions.

Under Essential Activities above, we outline existing efforts that contribute towards our outcome goals. Partnering with these people, projects and organisations will be important for achieving our goals. Essential partnerships will involve research organisations committed to working with agreed

principles (such as kaitiakitanga, rangatiratanga, manaakitanga) in a multi-disciplinary framework (including knowledge from community, iwi/hapū, and international expertise) to conduct discovery research describing the influence of social-ecological linkages on resilient natural and production ecosystems in New Zealand. Agreed principles ensure the fostering of capacity and capability through the development of early-career researchers and kaitiaki, nurturing of partnerships across industry-government-iwi/hapū at local case study to national network scales. Research organisations might include those with expertise in production systems (e.g. AgResearch, Plant & Food, Scion), natural systems, and ecological and social resilience (e.g. Universities of Canterbury, Auckland, Otago, Waikato, Lincoln University, Cawthron Institute, Manaaki Whenua – Landcare Research). Researchers may also have experience and knowledge of relevant research occurring in and funded by other NSCs, Centres of Research Excellence, MBIE, and the Health Research Council.

Large non-government organisations, such as Forest & Bird and Fish & Game, as well as other local project-focused NGOs, (e.g. Zealandia, NEXT Foundation, TerraNature, Queen Elizabeth II National Trust, NZ Landcare Trust, Waihora Ellesmere Trust, Working Waters Trust, Banks Peninsula Conservation Trust, Waimakariri Environment and Recreation Trust) are essential for case studies. They have established relationships with public participants engaged in biological heritage regeneration at local scales. It will be important to explore existing relationships between environmental NGOs and technology and health focused NGOs to identify potential new research partnerships in these areas.

The Sustainable Business Network (including Million Metres stream project) offer an opportunity to link with sustainability-focused industry members and could provide a key resource for establishing a national AMN. The Inland Revenue Department national business register is an additional source of national scale information/key points of contact for independent business operators. Additionally, individual farmers and farmer groups (e.g. Federated Farmers, Beef & Lamb NZ, DairyNZ) are an important resource of intergenerational knowledge (important for identifying temporal change in social-ecological linkages) and provide an industry perspective of multiple values/well-beings.

Local and central government partnerships will be essential for different scales of research implementation and impact. For example, central government (e.g. MfE, DOC, MPI) can enable essential activities through provision of information about 'restoration' initiatives resulting from national investment, such as 'exemplar' catchments in the Essential Freshwater programme (e.g. Kaipara), Sustainable Farming Fund (SFF) projects, and Hill Country Erosion Fund projects. Research outputs could inform policy and as such establishing project relationships with relevant central government departments will be a key measure of project progress. Local government partnerships might involve research participants such as scientists, community engagement/facilitation, planners and landscape architects.

The AMN proposed is predicated on joining up and informing the various fragmented restoration efforts. Thus, partnerships with a wide range of organisations are essential to its success. Some examples of these groups are listed for Goal 3 under Essential Activities above.

Essential resources

Personnel

Human resources will be key to the success of the project. Scientific personnel committed to multi-disciplinary research within the Challenge guiding principles and values, while recognising the importance of regenerating both cultural and biological heritage as one entity in New Zealand, are vital. The team will need skills in project management and communications, social science (including anthropology, economics, psychology, human geography, public health and sociology), ecological science (freshwater and terrestrial systems), complex systems, big data management and analysis, mātauranga, tikanga and kawa. They will also require experience in engaging with key stakeholders and multidisciplinary/transdisciplinary research projects, as well as a mixture of early, mid and late

career researchers. We will further support early career researchers, by assigning them as think piece champions, where national and international expertise will converge on specific topics.

A leadership team will be essential to coordinate effort and maximise outcomes across the three themes identified for SO6. Key individuals within the programme will further include 'influencers' who can provide a conduit between partnership organisations, especially in the establishment of the AMN.

Human resources will also entail support for kaumātua, iwi researchers, practitioners, kaitiaki, kaiarahi and *Te Rakau Tārake* members. Human resources will be essential for implementing a range of dialogue mechanisms to acquire, interpret and disseminate data and results (e.g. interview process, wānanga, workshops, hui and meetings). Capacity building programmes (e.g. Te Whare Wānanga) within communities and an extensive outreach, knowledge broker, and communications programme will require resourcing.

The Biological Heritage Team will be needed to provide essential support, especially in communications and relationship management at the national level with Challenge parties, key Challenge partners including DOC, MfE and MPI, and other National Science Challenges.

Co-design and network host

For Goal 2, directorship funding will contribute towards supporting the operation of iwi-led working groups where case studies are used.

For Goal 3, willing, engaged and co-ordinated local communities who are connected will be essential to build the AMN. Policies that incentivise the partners listed above to engage in the network will also contribute to its success. Beyond the willingness of the community to engage, the infrastructure to build a communication network, information hub and associated databases will be required. This will involve a significant time commitment from communicators and co-ordinators, website and database builders and managers. Social scientists will also be essential to undertake the scaling and communication network research .

Travel and wānanga/marae resources

Getting together teams of researchers, research partners, and on occasion key stakeholders, will require a significant investment in travel, accommodation, and host meeting fees. Marae-based hui and wānanga will be critical in some cases.

An international cross-cultural community exchange programme will be funded to explore how other indigenous peoples and non-indigenous communities balance values and trade-offs of values in environmental decision-making.

Other essential programme resources

Incentive funds or co-funding for new ideas that emerge as a result of think pieces or research developments and/or identified opportunities during the programme.

Section 3: Quantifying Cost Elements

Budget details and cost narrative

Goal 1

- Postdocs or FTE of junior researchers to lead think pieces.
- \$120k pa for think pieces.
- \$300k pa for fundamental research (surveys, meta-analysis) to explore: What are the key drivers of social-ecological linkages for Māori and non-Māori? What are the spatial and temporal patterns in social-ecological linkages that lead to positive outcomes for biological and cultural heritage? And analysis of case studies of restoration success and failures to identify the ways people (re)connect with nature as well as potential social-ecological pathways and barriers to regeneration of biological and cultural heritage.

Goal 2

- Probably \$500,000 per annum (this would support two case studies).
- Time is key expense – for iwi directorship and participation; researchers and participants.
- Funding also required for hui, workshops, travel.
- Can leverage in-kind support from DOC (staff time) and potentially financial support for FTEs to support iwi groups.
- \$50,000 per annum for cross-cultural international exchange programme.

Goal 3

- \$400,000 pa for building and running the AMN, includes a co-ordinator, a communicator and an IT person. These costs could potentially be shared/amalgamated with the 'Virtual Biosecurity Co-design Hub' that is being proposed by other SO groups.
- \$300,00 pa for science to build the evidence base to support the AMN.
- \$60,000 pa for each of two exemplar (\$120,000) regeneration projects.

Opportunities to leverage co-funding

There may be opportunities to leverage co-funding from two or more other National Science Challenges by identifying cross-cutting themes relevant to all, e.g. effective transition pathways for multiple well-beings, identifying keys to restoration successes and failures. This could sit from Innovation through to Scale out on the implementation pathway.

We see two key opportunities for additional investment: 1) funding restoration interventions to ameliorate degradation to the environment that has affected values held by groups (e.g. not being able to swim in local rivers); 2) funding capacity building of youth and early career researchers. Restoration interventions might best be funded by DOC (particularly on DOC land), philanthropists, NGOs, and regional and local councils. Public bodies would achieve discharge of their statutory duties with a greater mandate from local communities, and philanthropists could continue their philanthropy but with greater engagement and support from iwi and local communities, given that work would align with iwi or local community aspirations. Additional investment for capability building could be sourced from MBIE – both Endeavour Funds and Vision Mātauranga Capability Funds; Centres of Research Excellence (multiple bids and rebids involve themes that could contribute to SO6), and the Strategic Science Investment Fund. Some DOC area offices have also expressed interest to fund iwi capability restoration locally.

Opportunities exist for additional investment by the wide range of organisations that stand to benefit from the AMN. Because the wider NZBH Challenge would be able to use this network for connecting widely, it could be funded by multiple SOs. Moreover, such a network will be needed for the foreseeable future, so the aim should be for this to be self-sustaining by 2024.

There is considerable work being done by CRIs on non-market values (e.g. by Manaaki Whenua – Landcare Research) and transition pathways (e.g. by AgResearch), and it may be possible to leverage researcher time through SIFF funding.



Section 4: Evaluating Success

2024 Goal Metrics

	Measures of success		
Year*	Goal 1	Goal 2	Goal 3
2020	<ul style="list-style-type: none"> · Research efficiencies via coordination with other Goals and SOs identified. · Key individuals, including influencers, as well as co-aligned research identified. · Industry-community-iwi/hapū partnerships established. · Required technologies and resources in place (e.g. database, computing etc.) 	<ul style="list-style-type: none"> · Case study locations selected. · Think pieces conducted to identify key values or well-being outcomes. · Scalable values and well-being assessment methods scoped. · Inter-iwi research group established. · Cultural safety and data-sharing agreements established. · Process and aims introduced to other stakeholders. · Development of the international cultural exchange programme in year 2020. · Wānanga conducted to critique values framework. · Youth capability opportunities identified. 	<ul style="list-style-type: none"> · Initial contributors to AMN identified and commitments made. · AMN staff hired. · Science contracts finalised. · Workshops on AMN held. · Species or systems for exemplars identified. · Review literature on necessary components for success of the AMN.
2021	<ul style="list-style-type: none"> · Seed/incentive funds used to attract new partners/collaborators. · Expert workshop convened (incl internationals). · Co-design of surveys and selection of case-studies for meta-analysis complete. 	<ul style="list-style-type: none"> · Methods tested to evaluate values and well-being outcomes for wider community. · Broad within-iwi engagement ongoing – interviews and wānanga to derive values framework. · Youth capacity building opportunities engaged. · Values network mapping initiated. 	<ul style="list-style-type: none"> · Exemplar(s) started. · Infrastructure for AMN created. · Identification of successful restoration approaches and barriers begun. · Network functioning, and populations research ongoing.

<p>2022</p>	<ul style="list-style-type: none"> · Stock-take of current ways of understanding and communicating S-E (social-ecological) linkages complete. · Think piece on technology complete. · Think piece on scaling S-E linkages complete. · Translation of theory/concepts of S-E linkages into practice initiated. 	<ul style="list-style-type: none"> · Values and biophysical elements network mapping complete. · Where relationships and data currently exist, value frameworks developed. · Values and biophysical elements network mapping contribute to Goal 1 outcomes. 	<ul style="list-style-type: none"> · AMN being used for improving restoration success. · Research informing AMN ongoing. · Exemplars ongoing. · Pathways adopted respond to outcomes from Goals 1 & 2.
<p>2023</p>	<ul style="list-style-type: none"> · Think piece on changing attitudes towards valued introduced species complete. · Meta-analysis of positive drivers of S-E connection complete. 	<ul style="list-style-type: none"> · Wider communication – stakeholders updated. · Values networks shared, synthesised and questions asked of network adjusted according to feedback and requirements. · Community summit. 	<ul style="list-style-type: none"> · Widespread uptake of improvements for restoration success. · Recipes for success being distributed and published. · Exemplars informing AMN.
<p>2024</p>	<ul style="list-style-type: none"> · Translation of theory/concepts of S-E linkages into practice case-studies complete. · Next steps identified (the dynamic future of SO6). · Research of S-E linkages (methods, awareness, drivers, pressures) complete & published. 	<ul style="list-style-type: none"> · 'Best practice' guidance developed and shared. · Findings from Goal 2 will inform the delivery of AMN in Goal 3. · Follow up mapping of values scheduled (i.e. to assess progress). 	<ul style="list-style-type: none"> · AMN is self-sustaining and being regenerated itself. · Recipes for success being widely implemented.

*Note, these pertain to calendar years

SO6 Design Team

Jason Tylianakis (University of Canterbury)

Angus MacIntosh (University of Canterbury)

Anne-Marie Jackson (University of Otago)

Danielle Shanahan (Zealandia)

Joanne Clapcott (Cawthron Institute)

Phil Lyver (Manaaki Whenua – Landcare Research)

Ross Cullen (Lincoln University)

Graham Sevicke-Jones (Manaaki Whenua – Landcare Research)

James Holborow (Department of Conservation)

Karen Wilson (Environment Southland)

Stacey Bryan (New Zealand's Biological Heritage)

Olivia Burge (Manaaki Whenua – Landcare Research)