

NATURA Annual Report 2020-21

Nature-based solutions for Urban Resilience in the Anthropocene (NATURA)

National Science Foundation

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Accomplishments

Goals:

- Expand our network of networks to share knowledge and best practices about nature-based solutions in diverse socio-cultural, ecological-biophysical, and technological-infrastructure contexts across the research–practice divide
- Share ideas and data on research and implementation in multiple contexts to generate and disseminate synthesis of state-of-the-science knowledge about the role of nature-based solutions in social, ecological, and technological strategies for urban resilience challenges
- Establish and maintain lines of communication among research and practitioners in global networks to propel improvements in professional capacity and cross-sectoral collaboration
- Increase the capacity of the next generation of urban scholars to conduct and communicate interdisciplinary research on resilience concepts and nature-based solutions, and to integrate this work into transdisciplinary planning and implementation of nature-based solutions
- Provide a mechanism for practitioners to learn about interdisciplinary research on nature-based solutions that are more locally relevant to the decisions they make in their cities.
- Advance professional learning opportunities for undergraduate and graduate students through a partnership with Resilient Urban Latin America International Research Experience for Students.

Major Activities:

- 2021 NATURA Virtual All-Hands Meeting:
- The 2021 NATURA Virtual All-Hands Meeting (VAHM) took place from February 22-26, 2021, engaging network members in virtual discussions, presentations and intimate break-out conversations within The Nature of Cities (TNOC) Festival. The meeting created an opportunity to solidify Thematic Working Groups, as well as an opportunity for network members to exchange ideas, ongoing research and to pitch new and novel projects exploring the theory, practice and applications of nature-based solutions globally. The gathering allowed for network expansion with new networks/members joining NATURA after the TNOC Festival.

- By combining efforts with TNOC, NATURA Network members had access to 2,200 participants from 72 countries. The TNOC Festival offered members the ability to connect to a local place and ideas on a global scale for a broader perspective and participation. The Festival also allowed for NATURA members to showcase the exciting work being done across NATURA networks to the larger urban research and practice community.
- In total, we had ~65% of known NATURA members participate and we engaged with about 27 of our partner networks. NATURA members contributed to 45 events combined within the TNOC Festival and within internal meetings for the NATURA All-Hands Meeting. These 45 events included 2 keynotes, 2 field trips, 7 dialogues (short talks and transdisciplinary conversations among 3-4 thought leaders), 4 conversations (short talks and transdisciplinary conversations among 1-2 thought leaders), 25 sessions, and 5 meetings.
- Formation of Thematic Working Groups:
- After proposal review by the NATURA Steering Committee in Jan 2021, two Thematic Working Groups (TWGs) were launched at the 2021 NATURA VAHM. These include: (1) Urban Ecological Resilience and Traits, and (2) NBS Global Roadmap. These TWGs seek to advance synthesis on theory, research, and/or best practices related to nature-based solutions across diverse global social-biophysical contexts.
- Regular Thematic Working Group and Early-Career Network meetings:
- Six Thematic Working Groups (approx. quarterly) and the Early-Career Network (monthly) meet regularly (every 4-6 weeks or once per quarter) to share ideas, publications, and to work on group publications and projects.
- Monthly NATURA webinars:
- The monthly NATURA webinar series offers attendees the opportunity to get an overview of the networks that make up NATURA. Each webinar consists of two network presentations followed by a Q&A session where attendees can ask questions and build connections among networks. During the 2020-21 reporting period, NATURA organized 10 webinars including 23 speakers from across the network of networks.
- Regular NATURA regional nodes meetings:
- NATURA comprises five regional nodes: Asia-Pacific, Africa, Latin America, North America, and Europe. Regional nodes are led by co-PIs or core personnel; Nancy Grimm leads and coordinates the regional North America network node, Timon

McPhearson leads the Europe network node, Elizabeth Cook and Jordi Morato lead the Latin America network node, Pippin Anderson leads the Africa network node, and Weiqi Zhou and Yeowon Kim co-lead the Asia and Pacific network node. The regional leads are responsible for ensuring their networks remain active and integral to NATURA's full suite of networks. The regional leads hold quarterly virtual meetings for their networks to share updates and propose new cross-network collaborations.

- Monthly NATURA newsletter:
- The NATURA newsletter is released once a month and highlights opportunities (including paid positions and educational opportunities), resources, publications, presentations, events, and other relevant items pertaining to nature-based solutions around the world.
- Weekly posting to NATURA Twitter account:
- The NATURA Twitter account shares publications, opportunities, and events of interest with the NATURA network and others.

Objectives

- Expand the scope and advance research exchange on urban nature-based solutions by supporting Thematic Working Groups (TWG) and Regional nodes.
- Increase early career and graduate student opportunities for research and network exchange
- Advance research on nature-based solutions in the Global South
- Expand host networks who will support research fellowships for early-career scholars and practitioners
- Develop state-of-the-art regional knowledge for training undergraduate and graduate students on nature-based solutions leveraging expertise across the global network. This includes development of a new book co-edited by co-PI McPhearson, "Nature-based solutions for cities", forthcoming from Edward Elgar Publishing.
- Advance network interactions to build a global NBS case study database and to highlight research gaps for advancing knowledge for action on urban NBS for climate resilience
- Disseminate findings to diverse stakeholders, researchers, and networks through manuscript and white paper development and virtual and in-person events, conferences, and working-group exchanges

Significant Results:

NATURA Webinars:

<i>Webinar Date</i>	<i>Presenter</i>	<i>NATURA Network</i>
October 20, 2020	Pippin Anderson	African Centre for Cities
	JD Brown and Tim Beatley	Biophilic Cities
November 17, 2020	Dan Childers and Emma J Rosi	Central Arizona-Phoenix Long-Term Ecological Research (CAP-LTER and BES-LTER) project
	Dan Childers and Emma J Rosi	Baltimore Ecosystem Studies Long-Term Ecological Research (CAP-LTER and BES-LTER) project
December 15, 2020	Mario Balzan	ReNature
	Daniel Orenstein and Kinga Krauze	International and Integrated European Long-Term Ecosystem Critical zone and Socio-ecological Research project (ILTER and eILTER-RI)
January 19, 2021	Brad Gaolach	Western Center for Metropolitan Extension & Research (WCMER)
	Mariana Vidal Merino	PlanAdapt
March 23, 2021	Nancy Grimm, Timon McPhearson, Elizabeth Cook	NATURA Network reflection Mural Board
April 20, 2021	Henrik Dahl and Per Andersson	Future Position X Network

Figure. Webinar 12 NATURA in Review MuralBoard. This was the webinar where network members came together to evaluate how they interact with NATURA and to discuss ideas on how NATURA can better serve its community. Webinar participants wrote down thoughts and ideas on this MuralBoard.

Regional Nodes

- *NATURA Asia-Pacific Regional Node:* 1) Members completed a review paper on applications of NBS for urban flooding mitigation and adaptation (in Chinese with English abstract; manuscript under review). 2) Members did a comparative study of Beijing and New York that investigated the ecosystem services provision of urban greenspace and its association with socioeconomic factors (manuscript in prep).
 - Results from regional case studies were presented at the TNOC Festival: China (Zhou, Research Center for Eco-Environmental Sciences); Sri Lanka (Karunaratne, U Peradeniya); Japan (Kato, Okayama U); Australia (Hahs, U Melbourne); South Korea (Choi, Korea Land and Housing Corporation). Presenters explored the challenges of implementing and designing NBS for urban resilience specific to Asia-Pacific, potential opportunities to mainstream NBS, successes and failures from the region, and existing knowledge gaps.
- *Africa Regional Node:* The regional node discussed unique characteristics of African cities in its quarterly meetings and in the dialogue at the TNOC festival. This dialogue was led by the Africa Regional Node Lead, Pippin Anderson, and had participation from many prominent members of the node.
- *European Union Regional Node:* (1) Knowledge Exchange: hosted seed session at the TNOC Festival. (2) Andersson (Stockholm Resilience Centre and U Stockholm) is co-leading the Smarter Greener Cities initiative with other members of the EU node, to share knowledge, and test novel tools and processes for explicitly converging social, ecological, and technological systems (SETS) approaches to improve city liveability.
- *North American Regional Node:* Membership of this node includes several practitioner organizations along with academic research networks, such as The Nature Conservancy's Cities Program, the California university system's Cooperative Western Center for Metropolitan Extension, and the Urban Sustainability Directors Network in the US. Building from discussions in node meetings and at the TNOC Festival, the North American node is planning to prepare a white paper on

pathways to take action on NBS, driven largely by these action-oriented participants.

- *Latin America Regional Node:* Latin America members participated in UNESCO, Recycling the City Network (RECNET), and San Juan ULTRA regional meetings. From these meetings, new participants / Latin America networks became network members of NATURA. The node met formally three times throughout the second year of NATURA with approximately 50 participants joining via Zoom from Colombia, Mexico, Peru, Ecuador, Brasil, Chile, Argentina, Puerto Rico, and participants living outside of Latin America from Denmark, USA, and Spain. Members organized a symposium on best practices, lessons learned, and barriers to NBS implementation in Latin America at theTNOC Festival. Finally, in collaboration with the North American Regional Node, members supported the leveraged, NSF-funded Resilient Urban Latin America International Research Experience for Students (RULA IRES) project, which funded five students' research in San Juan in summer 2021.

Thematic Working Groups:

- *Urban Informality and Innovation For Resilient Futures:* The group involved the Mayor's office of Bogotá in the TNOC Festival/VAHM, opening lines of communication with other local partners. The group hosted three major thematic events with high level representatives, including perspectives from Spain, Puerto Rico, Tanzania, and Colombia. The TWG showcased the work of RULA IRES students, opening a channel for interaction with early career students. The group developed a strategy to integrate local scenarios for research and experimentation with practices of resilience and NBS. The group also developed a framework for "radical resilience" from the viewpoint of informal settlers.
- *Urban Ecological Resilience:* Members of the TWG published a paper in the new Nature npj Urban Sustainability journal that explores traits as a way to examine social-ecological systems. The paper offers a framework and language for connecting ecological resilience to the wider urban SETS. A case study in Lisbon anchors a new conceptual framework linking traits, ecosystem services, and social-ecological systems (submitted to BiolScience). A book chapter on urban ecological resilience will be a core TWG product contributed to the new NATURA book "Nature-based Solutions for Cities" that is in contract and due to be published in early 2022.

- *Urban Science to Support the Convention of Biological Diversity (Urban Nature):* This TWG participated in drafting a report and messages from the 5th Science and Policy Forum integrating input from COP15. The messages and recommendations were presented at the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) meeting in May 2021.
- *Global to Local:* The Global to Local TWG presented during the VAHM on ways to increase coordination between global biodiversity targets (such as the Aichi Targets and the Post-2020 Global Biodiversity Framework) and local biodiversity plans. Organizers presented preliminary results of the research, which involved 45 local plans. They identified which Aichi Target themes were found in the local plans (most and least common are listed in order). Also during the seed session, they had an interactive discussion about what cities need to improve biodiversity planning, presenting results of a Biodiversity Plan Survey administered in 26 countries and 44 cities. The most prevalent themes included “Awareness increased” and “Knowledge improved, shared and applied”, each addressed in 93% of plans. However several subcategories were NOT reflected in global CBD targets. These survey data can be used to inform the post-2020 targets now in development to ensure they represent realities on-the-ground.
- *NATURA Design for Justice:* 1. Members of the TWG developed a theoretical framework to define design justice in NBS projects. A manuscript is in the work. 2. A survey questionnaire has been developed to gauge the state of practice in NBS. A pilot study was executed, and the group is revising the questionnaire and plans to launch the survey to NATURA networks in Fall 2021.
- *Early Career TWG:* Members of the EC group have developed one white paper on NBS for urban resilience, one podcast (Future Cities), infographics presenting the early career perspectives in NBS definitions and opportunities and barriers in implementing NBS in diverse global contexts. The EC group also shares information about upcoming job opportunities, conferences, etc. in an active Slack group.
- *Global Roadmap TWG:* This working group is contributing to the World Economic Forum Global Commission on BiodiverCities. A major global review paper (invited, One Earth, to be submitted) on nature-based solutions research that spans the NATURA regions brings regional experts together that review regionally based literature and make recommendations for how NBS can be mainstreamed within

and across regions. Expansion of the TWG to link regional databases with case studies on NBS and engage the regional nodes is planned for 2021-2022.

- *Nature-Based Pathways*: This working group has the goal of learning from a compendium of successful transformations involving NBS to determine what they have in common in terms of barriers, inflection points, actors, and governance structures. The TWG developed a framework for considering the enabling steps for NBS transformations, involving stewarding, unlocking, transforming, and orchestrating, and piloted a process to fit known NBS successes into this framework. In 2021-2022, the TWG plans to expand its membership and invite other interested network participants to contribute to the compendium, with the ultimate objective of preparing a paper for publication that shows the potential for NBS to foster sustainable and resilient futures.

Key outcomes or other achievements:

- *Participation growth*: Since inception, the number of [networks](#) in NATURA increased from 26 to 43. The regional nodes all increased their members: Europe from 35 to 53, Africa 41 to 43, Latin America 64 to 71, North America 47 to 59, and Asia-Pacific from 27 to 33. Membership in the Early Career Network increased by 25% (now 83 members).
- **Two [TWGs](#)** were established as a result of the 2021 Virtual All-Hands Meeting (VAHM) at the TNOC Festival: 1) Urban Ecological Resilience and 2) NBS Global Roadmap. Since the VAHM, all TWGs have accepted sign-ups of people interested in participating and have begun to hold internal discussions.
- **19 networks** have presented to the NATURA community in monthly webinars (Table 1). Attendance is commonly 30-50 people. NATURA has also held one collaborative webinar where network members/attendees were given the opportunity to give feedback on five main areas: 1) overview of objectives, 2) All-Hands Meetings and webinar activities, 3) Thematic Working Groups and Regional Nodes, 4) Early-Career Network and Fellowships (formerly known as Learning Exchanges, 5) new activities. Results from this webinar have led to notable changes within NATURA, including streamlining internal and onboarding processes as well as enhancing network communication.
- At the time of this report, three Early-Career Fellowships have been launched and are in progress. The NATURA Early-Career Fellowship Program is a paid 6- or 15-week opportunity for research and networking at collaborating network

institutions ([click here](#) for participating locations). The goal of the fellowship program is to 1) Provide opportunities for students, early-career academics, and practitioners to explore nature-based solutions for urban resilience by spending time in residence with other networks; 2) Support greater depth of analysis or synthesis by extending time of interaction; 3) Support practitioner-researcher interactions through exchanges among worldwide networks.

- The NATURA Network has engaged with its community through communication via [webinars](#), [All-Hands meetings](#), a shared Google calendar, a [website](#), a Slack workspace, and a monthly newsletter, which is disseminated regularly and as needed. Network points of contact and individuals are able to sign-up through a Google form available on the website; presentations from webinars are also made available on the website.
- **11 Newsletters** have been released from October, 2020-September 2021. Within these newsletters, we have connected NATURA members to 73 opportunities, 30 publications, 24 resources, and 22 presentations.
- We continue to deploy Twitter as a communication tool to disseminate news and research from network members, as well as other resources connected to NBS, urban nature, urban resilience, and other urban systems work.
- Most of NATURA's five regional nodes (North America, Latin America, Europe, Africa, and Asia-Pacific) have held quarterly meetings with their groups and have used the NATURA Zoom rooms to do so.

Opportunities for training and professional development

NATURA [Early-Career network](#):

- The Early Career (EC) Network has seen significant growth over the past year. The aim of the network is to support early-career professionals through regular virtual meetings, email, and Slack messaging to promote networking opportunities, share information, and offer peer to peer support to one another. The EC group is working collaboratively to disseminate the perspectives of EC professionals working on NBS globally through non-academic communication mediums to broaden the audiences and readers of NBS topics such a white paper, infographics, and podcasts. This reporting period, members of the EC group participation increased by 25%. The entire EC group met monthly (about 10 times) and the sub-project groups met multiple times as necessary throughout the year. We have also seen an increase in representation from regions in the Global South.

- The EC group hosted a session at the VAHM, and had a participation of around 50 EC researchers and practitioners around the world.
- A member of the EC Network, Filipa Grilo from Lisbon, Portugal is the lead author on a new BioScience paper submission, providing a key opportunity for research leadership. The paper presents a conceptual model for linking traits and ecosystem services.
- The EC group has facilitated the individual-level research collaborations, knowledge sharing, and peer-mentoring on career development stemmed from the group networking.

NATURA Research Fellowship and Learning Exchanges

In 2020, we launched a new fellowship and learning-exchange program to provide opportunities for students, early-career academics, and early-career practitioners to explore NBS for urban resilience by spending time in residence with other networks. Through virtual or in-person site visits, the aim of the program is to support greater depth of analysis or synthesis on NBS, and to foster practitioner-researcher interactions through exchanges among worldwide networks. So far we have support three fellowship exchanges:

- Laura Costadone, a PhD student at Portland State University, is conducting an analysis of social environmental justice on blue-green space access using social media data in a Mediterranean small island state, as part of the ReNature network in Malta (host: Dr. Mario Balzan, ReNature Network).
- Melissa Ingaruca Moreno, design-led urban researcher based in Berlin, is working on a project to assess the transformative potential of urban NBS at the Urban Systems Lab, The New School in New York City (host: Dr. Timon McPhearson, UREx, SETS Convergence).
- Clair Cooper, a PhD student in the Department of Geography at Durham University, UK is also working with the Urban Systems Lab on a project investigating the role of social media data in the evaluation of relationship between nature-based solutions and health.

Student Research Awards on Nature-based Solutions

In 2021, the NATURA project launched a new program to support student research on nature-based solutions and to advance knowledge production across the networks. Research will relate to core NATURA themes explored in facilitated network collaborations

such as webinars, working groups, all-hands meetings, and others. We expect to support up to 5 research proposals during the 2021-22 academic year.

Student Research Experiences:

Several members of the Latin American and North American Regional Nodes co-lead and contributed to an NSF grant proposal, Resilient Urban Latin America International Research Experience for Students, (RULA IRES), which was funded to support 10-week summer student research projects with NATURA partners in Ecuador, Chile, Colombia, and Mexico. Five students (three undergraduate and two graduate students) completed a 10-week summer research experience in 2021, funded by a previous RULA IRES grant that became affiliated with NATURA and focused on NBS and community perceptions of the Rio Piedras in San Juan, Puerto Rico. The students conducted community interviews about flood perceptions and the intervention of proposed green infrastructure projects. Prior to the San Juan experience, hosted by Melendez-Ackerman (San Juan ULTRA, U Puerto Rico), the students met with NATURA members Hernan Lopez (Barcelona, RECNET, UNESCO) and RULA IRES PIs Grimm (ASU, UREx, LTER), Cook (Barnard, UREx, LTER, SETS Convergence), and Feagan (ASU, UREx) to develop research questions and methods for study of urban informal settlements in Bogotá, although this experience had to be canceled due to the pandemic. Together, the pre-summer workshops on Bogotá and San Juan, the summer experience, and the exposure to the urban informality TWG at the TNOC Festival had a major impact on several of these students' future plans and career directions.

Monthly newsletter:

- Opportunities (including paid positions and educational opportunities) are included in each newsletter every month.

Staff career development:

- Tessa Martinez, who joined NATURA as its Administrative Assistant, has acquired skill in use of Zoom technology, developing newsletter and other material, website design and content, calendar organization, and developing agendas and leading meetings of the Executive Management Team and the Coordinating Committees. Tessa's role has evolved from Administrative Assistant to Project Coordinator.

- Christopher Kennedy, NATURA's Outreach Coordinator, has further honed his web development and communication skills through development of the NATURA website.
- Dr. Yeowon Kim, NATURA's Postdoctoral Fellow, has had the opportunity to lead a group, the Early Career Network, and develop contacts around the world who share her interests in nature-based solutions. She has also worked with Weiqi Zhou to lead the Asia-Pacific regional node for NATURA. These roles are helping Kim to hone her communication and leadership skills. She has advanced her career to a faculty position by demonstrating her leadership in international research collaboration through NATURA.

Dissemination of Results

- Monthly newsletter
- Email
- Weekly Twitter posts
- Monthly webinar
- [2021 NATURA Virtual All-Hands Meeting](#)

Members of the NATURA Network have developed several manuscripts now in review, or published.

- Jesse DeMaria-Kinney, Deputy Director for PlanAdapt is developing a manuscript exploring Urban Ecosystem-based Adaptation in the Global South, leveraging results of survey
- Christopher Raymond published a new book, "Changing Senses of Place: Navigating Global Challenges", Cambridge University Press
- Timon McPhearson is co-author of several NBS related publications with NATURA network members, and co-editor of the book Resilient Urban Futures, Springer (downloaded over 21,000 times since April 2021)
- Art Branny is developing a manuscript exploring NBS and green post-COVID economic recovery; Clair Cooper is finalising a manuscript on the relationship between NBS and population health in complex systems
- Rory Curtin published a brief article on the food system in Lisbon in Resilience Quarterly
- Rik De Vreese co-authored an article on the impact of the COVID-19 pandemic on the use of and attitudes towards urban forests and green spaces, based on a survey

in Belgium. He is also co-author of an article on co-design processes to address nature-based solutions

- Björn Wickenberg published a review article on advancing frameworks on implementation of NBS in cities, and authored a reflection piece for The Conversation, “Slow down and embrace nature - how to create better cities when the pandemic is over”.
- Yeowon Kim and Nancy Grimm authored a peer-reviewed journal article on “Capturing practitioner perspectives on infrastructure resilience using Q-methodology” published in Environmental Research: Infrastructure and Sustainability.

NATURA network members shared research at several conferences, public lectures and other engagements:

- Co-PI Cook presented NATURA-related work at the San Juan ULTRA Symposium.
- Members of the EU Regional Node attended/participated in the event, “The European Green Deal & Nature-based Solutions”, organized by the IUCN European Regional Office on December 14, 2020. Hosted together with the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN). The event’s objectives are to create continued momentum towards NbS for people, biodiversity and climate and to demonstrate the potential of NbS to address our global challenges
- Co-PI McPhearson presented at the University of Oxford’s Nature-Based Solutions Digital Dialogues conference, as part of the Financing Nature-based Solutions panel; Cooper presented Temporal Distribution of NBS and implications for Climate Justice at World Climate Justice Forum; Members of the EU Regional Node attended and presented during the Urban Forestry Days (22-23 March 2021) organised by EFUF, EFI and the CLEARING HOUSE project.
- Co-PIs McPhearson, Cook, Grimm, and Postdoc, Kim, presented at the [2021 National Science Foundation Accelnet Meeting](#) in April of 2021.
- Co-PI McPhearson was involved in the development of a new journal Nature-based Solutions which launches at the end of 2021.

Plans for Next Year

- Continue and expand the NATURA Early-Career Fellowships
- Continue monthly newsletters

- Continue weekly Twitter posts
- Continue monthly webinars
- Continue to fund accepted Student Research on NBS awards and release another call for proposals in the spring of 2022
- Thematic Working Groups (TWGs) will continue to meet regularly and work towards their stated goals
 - NATURA Design for Justice: The goals of NATURA Design for Justice working group are three: 1) create a platform to share insights into aspects of procedural and distributive justice in nature-based solutions research and practice across international communities in the network; 2) identify opportunities for synthesis across the network related to justice processes and outcomes and translate ideas into proposals for future funding; 3) co-develop actionable plans to make equity and justice accountable in NATURA projects.
 - Nature-Based Pathways: The goals of Nature-Based Pathways working group are: 1) Identify nature-based solutions, visions, pathways, framings and knowledge gaps; 2) Compare datasets and methods to recognize and assess NBS, innovation, and transformative capacity; 3) Identify transdisciplinary practices for catalyzing and managing NBS transformations
 - Global to Local: 1) Based on local practice, identify which national-level goals in the Strategic Plan 2011-2020 and/or Post-2020 Global Biodiversity Framework of the Convention on Biological Diversity are most relevant in an urban context; 2) Suggest indicators that can be used at the urban level to measure progress towards these global targets; 3) Conversely, explore how local nature-based solutions and approaches to biodiversity conservation can inform global frameworks; 4) Provide inputs to the development of the post-2020 framework to improve coordination between global processes and parallel efforts by local governments on nature-based solutions planning; 5) Highlight best practices and support international city-to-city learning of urban nature-based solutions and biodiversity strategies.
 - Urban Nature: This NATURA Thematic Working Group will for the coming year focus on mobilizing scientific knowledge through a global network of scientists and practitioners present at various sessions/meetings before and during COP15 in Kunming May 17-30 2021, and the associated 7th Summit of Cities and Subnational Governments, and Science Forum/International

Conference on Science and Sustainability. We will specifically focus on scientific knowledge relevant to the new Convention on Biological Diversity goals and targets that are currently under negotiation, and will be adopted at the COP 15.

- Urban Informality: This working group has three goals: 1) to advance understanding of informality, by developing diagnostic tools to detect key aspects of informality that can have positive or negative impacts on resilience, especially as regards implementation of NBS initiatives; 2) to contribute to improving the implementation of NBS in contexts of informality by analyzing good practices and lessons learned from experiences brought and shared by group members, culminating in a community of learning and a comprehensive compilation of applied tools and appropriate technologies from real-life situations; 3) to explore and develop mechanisms for enhancing governance for the implementation of NBS initiatives. Under this goal, the TWG will explore different examples of multistakeholder governance and decision making that leads to sustainable urban transformations with NBS.
- Integrating Urban NBS and the Sustainable Development Goals (SDGs): The goals of the Integrating Urban NBS and the SDGs working group is: 1) Gap analyses of urban nature-based solutions and SDGs; 2) Conflicts and barriers of urban nature-based solutions and SDGs; 3) Horizon scanning of urban nature-based solutions and SDGs; 4) Development of the connection between the NBS approach and the SDG approach
- The NATURA Network will be releasing another Call for TWG Proposals at our 2022 All-Hands Meeting
- The NATURA Network will be releasing a Call for Proposals for Early-Career Fellowships in November of 2021
- NATURA Regional Nodes will continue their regular meetings

Products

Published, or in-press journal articles, books, book chapters, conference presentations that acknowledge NSF (Grant #1927468 and #1927167).

Journals:

- Wendling, L., Garcia, J., Descoteaux, D., Sowińska-Świerkosz, B., McPhearson, T., Frantzeskaki, N., et al. (2021). Editorial: Introduction to the Nature-Based Solutions journal. *Nature-Based Solutions* 1, 100003. doi:10.1016/j.nbsj.2021.100003.
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McPhearson, Timon, Cook, Elizabeth, Berbés-Blázquez, Marta, Grimm, Nancy, Cheng, Chingwen, Barbosa, Olga, Chandler, David, Chang, Heejun, Chester, Mikhail, Childers, Dan, Eakin, Hallie, Groffman, Peter, Hale, Rebecca, Iwaniec, David, Lugo, Ariel, Markolf, Sam, Matsler, Marissa, McPhillips, Lauren, Miller, Thaddeus, Rosi, Emma, Swindell, David, Chowdhury, Rinku Roy, and Troxler, Tiffany. 2020. A Social-Ecological-Technological Systems Framework for Urban Ecosystem Services. One Earth. accepted

McPhearson, T., Frantzeskaki, N., Blatch, T., Culwick Fatti, C., Grimm, N., Herreros-Cantis, P., Kavonic, J., Lin, B., Matsler, M., Moglia, M., O’Farrell, P., Jakub Grabowski, Z., Ossola, A., Roy, P., Singh, C., Wang, J., Zhou, W. (2020). A global review of nature-based solutions for urban climate change adaptation. One Earth.invited and in prep.

Books:

Nancy Grimm, Harini Nagendra, Gina Lovasi, Nadja Kabisch, Gregory Bratman, Rieke Hansen, Brian McGrath, Timon McPhearson, Lauren McPhillips, Paul Coseo and Zoe Hamstead. “Nature-based Solutions for Cities”, Editors: Timon McPhearson, Niki Frantzeskaki, Nadja Kabisch. Edward Elgar Publishing, UK. in contract.

“Nature-based Solutions for Cities” will bring multiple and diverse perspectives together to describe the current state of the art in advancing nature-based solutions. In particular, we aim at understanding how NBS can be better managed, planned, and engaged with, and to answer questions of NBS for what and for whom? How far are we from a nature-based urbanism? Through chapters led by experts in both global south and north contexts, we will describe key knowledge and learning for advancing the science of NBS in cities and discussing the frontiers for next-generation NBS. Authors and editors are largely drawn from participants in the NATURA network. The book will engage students, researchers, and practitioners from different backgrounds and professions, as well as actors in urban planning and decision-making.

Book Chapters:

McPhearson, T. (2020). Transforming Cities and Science for Climate Change Resilience in the Anthropocene. In K. Hölscher & N. Frantzeskaki (Eds.), Transformative Climate Governance: A Capacities Perspective to Systematise, Evaluate and Guide Climate Action (pp. 99–111). Springer International Publishing.

https://doi.org/10.1007/978-3-030-49040-9_3

Conference Papers and Presentations:

Cook, E.M. 2021. Identifying global knowledge gaps on nature-based solutions for urban resilience. San Juan ULTRA Symposium; Virtual, 8 April 2021.

Cook, E.M. 2021. Building urban resilience with nature-based solutions and a global network of networks. The Nature of Cities Festival; Virtual, 22-26 February 2021.

Elizabeth Cook, Nancy Grimm, Timon McPhearson, and Yeowon Kim, 2020. [INS 7- Nature-Based Solutions for Urban Resilience in the Anthropocene \(NATURA\)](#). Session at the ESA Annual Meeting, Virtual.

Nancy Grimm, Timon McPhearson, Elizabeth Cook, and Yeowon Kim, 2020. [Nature-based solutions for urban resilience in the Anthropocene: Introducing the global NATURA network](#). Presentation at the ESA Annual Meeting, Virtual.

Timon McPhearson, Elizabeth Cook, Nancy Grimm, Marta Berbés-Blázquez, and Chingwen Cheng, 2020. [A SETS approach to urban nature-based solutions](#). Presentation at the ESA Annual Meeting, Virtual.

Yeowon Kim, Nancy Grimm, Elizabeth Cook, and Timon McPhearson, 2020. [Visioning for a network of networks facing future challenges with nature-based solutions](#). Presentation at the ESA Annual Meeting, Virtual.

Marissa Matsler, 2020. [Say what you mean! Organizing the promises of green infrastructure with the Eco-Techno Spectrum](#). Presentation at the ESA Annual Meeting, Virtual.

Lauren McPhillips, 2020. [How well does green stormwater infrastructure work and how can we do better?](#). Presentation at the ESA Annual Meeting, Virtual.

Zbigniew Grabowski, Timon McPhearson, and Steward Pickett, 2020. [Deep dives on equity in US green infrastructure planning](#). Presentation at the Ecological Society of America Annual Meeting, Virtual.

David Maddox, 2020. [Every effort in nature-based solutions includes deep veins of justice and equity](#). Presentation at the ESA Annual Meeting, Virtual.

Alessandro Ossola, 2020. [Making nature based solutions work in a 50°C world](#). Presentation at the ESA Annual Meeting, Virtual.

Participants

Coordinating Committee Members

- Nancy Grimm
- Elizabeth Cook
- Timon McPhearson
- Yeowon Kim
- Christopher Kennedy
- Tessa Martinez
- Harriet Bulkeley
- Marcus Collier
- Pippin Anderson
- Weiqi Zhou
- Jordi Morató
- Chantal van Ham

Participating Networks

African Center for Cities at the University of Cape Town
Biophilic Cities
Centre for Urban Transitions
Chinese Academy of Sciences Research Center for Eco-Environmental Sciences
Connecting Nature Trinity College Dublin
East Asia-Pacific Long-term Ecological Research (LTER)
ENABLE
ENVISION
European Forum on Urban Forestry
European LTER
Future Earth Urban Knowledge Action Network (KAN)
ICLEI Europe (Local Governments for Sustainability)

International LTER (ILTER)
IUCN Urban Nature Alliance
Natural Capital Project
Recycling the City Network (RECNET)
The Nature Conservancy North American Cities Program
The Nature of Cities
UNESCO Chair on Sustainability (UNESCO-SOST)
UNESCO European Regional Centre for Ecohydrology (ERCE)
Urban Resilience to Extremes Sustainability Research Network (UREx)
Urban Sustainability Directors Network (USDN)
Urban Water Innovation Network (UWIN)
US LTER
VIVA-PLAN
ICLEI Africa CitiesWithNature Initiative
USDA Forest Service- Urban Field Station
CREATE Initiative
Beyond the Academy Network
San Juan ULTRA Network
SMARTer Greener Cities
Urban Biodiversity Hub (UBHub)
PlanAdapt Network
Re-Nature Project
Western Center for Metropolitan Extension
Future Position X network
BIG Project

Oppla
Intemperie Studio
GoGreenRoutes
European Forest Institute
CLEARING HOUSE
Hyphae

Other collaborators

- Laura Costadone is conducting a NATURA research fellowship focused on an analysis of social environmental justice on blue-green space access using social media data in a Mediterranean small island state. Laura is working under the supervision of NATURA network member Mario Balzan in Malta, as part of the Horizon 2020 project, which promotes research excellence in nature-based solutions for innovation, sustainable economic growth and human well-being in Malta.
- Melissa Ingaruca Moreno is working with NATURA network member Timon McPhearson at the Urban Systems Lab, The New School in New York. She is conducting research on the transformative potential of urban nature-based solutions. This project seeks to develop a SETS-based theoretical framework to assess the potential of urban NBS innovations to radically transform the modernist urban design regime and create pathways towards “good Anthropocenes”.
- Clair Cooper is working with NATURA network member Timon McPhearson at the Urban Systems Lab, The New School in New York. She is conducting a study investigating the role of social media data in the evaluation of relationship between nature-based solutions and health.

Impacts

Impact on the development of the principal discipline:

- NATURA network members are collaborating on the development of a manuscript exploring global perspectives on nature-based solutions to expand the scope, reach and implementation of effective NBS strategies across geographies and multiple scales.
- Network members are developing projects to improve understanding of the contribution of NBS to ecosystem protection, restoration and management, and how NBS support the delivery of vital ecosystem services.
- Our work is exploring the role of NBS in physical and mental health, quality of life, social cohesion, and new perspectives on improving health outcomes for urban citizens.
- Research exchanges facilitated by the network are providing new understanding of the resilience of NBS to climate change, and proposing new integrative frameworks to complement existing knowledge, especially across diverse geographic areas.
- Members of the Asia-Pacific Node are conducting research on applications of NbS for urban flooding mitigation and adaptation.

Impact on other disciplines

- Environmental and Social Justice: The NATURA Design for Justice Thematic Working Group has developed a theoretical framework to define ‘design justice’ in nature-based solutions projects. A manuscript is now being prepared.
- Economics: Members of the NATURA network and the Connecting Nature network organized a virtual summit in June 2021 exploring ways cities can adapt to living with Covid-19 and implement recovery strategies leveraging nature-based enterprises to become the engine for sustainable economic and jobs growth. The Summit has built new knowledge on economic benefits of NBS, as well as policy synergies and connections.
- Knowledge exchange and synthesis of nature-based solutions from diverse disciplines and global locations that integrate art, cultural understanding and humanities into qualitative research and practice on NBS. This was a focus of the NATURA VAHM during the TNOC Festival in February 2021.
- Urban Planning: NATURA members co-led a special workshop during our All Hands Meeting bringing together ecosystem service scientists, urban planners, and

municipal decision-makers to generate and improve approaches and tools that integrate nature's contributions to people into the equitable design and re-design of cities.

Impact on the development of human resources

- The NATURA Early-Career Network has created a unique forum for early-career practitioners and researchers can engage with each other, share information, and offer peer to peer support.
- NATURA continues to cultivate professional learning opportunities for two people on staff– Tessa Martinez, Assistant Project Manager and Christopher Kennedy, Outreach Coordinator. This includes adaptive planning, project management, facilitation of international research exchanges, and organizing public virtual events.
- The NATURA newsletter also includes job postings, relevant research, and training opportunities for network members and colleagues.

Impact on teaching and educational experiences

- NATURA activities have brought together a diverse group of students across backgrounds and disciplines through participation in monthly webinars, the All-Hands Meeting and The Nature of Cities Festival, and participation in thematic working groups and regional nodes.
- The NATURA Early-Career Fellowship and Student Research Awards create a platform to support student-led research on urban nature-based solutions, and creates opportunities for collaborative knowledge sharing, publishing, and novel research.
- NATURA members were included as guest speakers in PI and Co-PI courses including McPhearson's Urban Resilience course at The New School.

Impact on institutional resources

- NATURA is adding capacity and increasing network connections with important global networks in NATURA including The Nature of Cities, the ICLEI-led Cities with Nature partnership that includes core partners IUCN and The Nature Conservancy
- NATURA continues to provide core networking resources through webinars, working groups, Slack communication, and meeting facilitation to to key regional networks including e.g. bringing together multiple NBS networks in the Global

South together both within the Latin America and Asian Pacific regional node in NATURA, but also to link with other NBS networks in other regions.

- The NATURA web platform has been improved with additional resources to catalyze network exchanges, to serve as a resource and repository for NATURA publications and products, and as a forum for Thematic Working Groups and networks to share ongoing research. The website further provides a dynamic space for hosting Webinar information and resources, a space for network members and interested individuals to join our Newsletter, and to learn about upcoming events related to NBS around the world. The website also played a key role in helping to facilitate, organize, and host resources for the NATURA All-Hands Meeting in 2021. In the future, we plan to add a robust database of NBS case studies from each network member, a more dynamic blog space to feature network members, and results from early career research exchanges.
- The NATURA Slack workspace continues to offer a platform for Thematic Working Groups, Regional Nodes, Executive Management Team, Coordinating Committee, and just general members to share information and communicate with one another.
- We continue to deploy Twitter as a communication tool to disseminate news and research from network members, as well as other resources connected to NBS, urban nature, urban resilience, and other urban systems work.

Impact on Society beyond science and technology

By engaging practitioners and non-academic community in knowledge exchange and synthesis through webinars and thematic working groups, NATURA seeks to advance resilience and sustainability of global cities and populations in the face of future climate challenges