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"Norway in Red, White and Grey": Empowering civil society with big data and ecosystem extent accounting methods to stop nature loss

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"In nature no one sees the whole picture." Mads Nyborg Støstad, NRK

In January 2024 The Norwegian Public Broadcasting Corporation (NRK) published an article illustrating how during the last 5 years Norway has lost 208 km2 of nature to land clearing and building, or a total on average 79 m^2 per minute. This figure includes the equivalent of two soccer fields of nature mapped as "particularly valuable" according to different official categories. In a matter of a few days the story became one of NRK's top ten most read online news ever. It has led to a step-change in public perception of the urgency for action, supported by knowledge in ecosystem accounts, particularly at local project and municipal level.

The paper discusses the narrative used to present the extent accounting data and the nature values it identifies. In the language of SEEA EA we focus on how biophysical ecosystem extent mapping and accounting – through digital story-telling methods – also represents nature values, even before having generated biophysical and monetary ecosystem service accounts. We analyse the case study according to principles for natural capital accounting fit-for-policy purpose (Ruijs et al. 2019) and study design criteria for increasing uptake of ecosystem assessment in policy (Barton et al. 2022): Timeliness, Salience, Credibility and Legitimacy . We discuss how societal uptake is achieved using journalistic methods of public dissemination of ecosystem extent accounting knowledge based on remote sensing data that is usually only accessible to scientists and statisticians. It is a case study in the use of personal narratives and multi-media methods by NRK to connect with nature values deeply held by the public. Researchers used apps that allow civil society actors - such as a public broadcaster - to generate ownership to ecosystem accounting data through co-producing the uncertainty auditing using peer reviewed methods (Venter et al. 2024).   We conclude by discussing how this type of dissemination work achieves the connection of SEEA EA to local community (IPLC) plural values for nature as recommended by the IPBES Values Assessment Summary for Policy Makers (Pascual et al. 2023; IPBES 2022).

Background

The IPBES Values Assessment (Pascual et al. 2023; IPBES 2022) reviewed several thousand scientific publications using a range of methods to value nature's contributions to people, finding that less than 5% of studies could document uptake of results. Valuation methods included ecosystem services, but at the time of the IPBES review there were few published examples of ecosystem accounting. Ecosystem accounting has only recently become an international statistical standard (United Nations 2021). Scientific publications on ecosystem accounting by early adopters of ecosystem accounts such as the Netherlands and UK are examples of studies that document uptake by the IPBES review criteria – i.e. documenting how ecosystem assessment can support government policy at a number of levels (e.g. Dickie and Neupauer 2019; Hein, Bagstad, et al. 2020; Hein, Remme, et al. 2020; Maes et al. 2020).

The IPBES Values Assessment referred to a list of general criteria to increase stakeholder uptake of ecosystem assessments (Barton et al. 2022), including timeliness, salience, credibility, legitimacy, cost-effectiveness of methods and resourcing. More specifically, Ruijs et al. (2019) reviewed experiences with natural capital accounting to derive 10 principles to make NCAs fit-for-policy purpose, encouraging engagement with policy-makers, civil society and the private sector (Table 1). There is still limited documentation on incorporating knowledge from accounts into actual policy-making processes. This paper analyses the case of 'nature encroachment accounts' collaboration between NRK and NINA using the principles developed by Ruijs and colleagues:

Inclusive - we look at engagement with civil society, and in particular collaboration with journalists to popularize findings from a simple version of extent accounting.

Collaborative - the paper shows how journalists participated in validating remote sensing data for accounts using citizen science methods.

Decision-centered – journalists focused reporting on authorities' lack of nationally consistent maps and lack of national statistics on overall loss of nature and policy prioritised nature types.

Table 1 – 10 principles for NCAs fit-for-policy purpose (Ruijs et al. 2019)

Comprehensive	
Inclusive	Acknowledging the diverse stakeholders concerned with decisions affecting natural capital, responding to their information demands, respecting different notions of value, and using appropriate means of engagement
Collaborative	Linking the producers of NCAs, the users of NCAs for policy analysis and the policy-makers using the NCAs results, and building their mutual understanding, trust, and ability to work together
Holistic	Adopting a comprehensive, multi/interdisciplinary approach to the economic and environmental dimensions of natural capital and to their complex links with policy and practice
Purposeful	
Decision-centred	Providing relevant and timely information for indicator development and policy analysis to improve and implement decisions with implications for natural capital
Demand-led	Providing information actually demanded or needed by decision makers at specific levels
Trustworthy	
Transparent and open	Enabling and encouraging public access and use of NCAs, with clear communication of the results and their interpretation including limitations of the data sources, methods, and/or coverage
Credible	Compiling, assessing, and streamlining data from all available sources, and deploying objective and consistent science and methodologies
Mainstreamed	
Enduring	With adequate, predictable resourcing over time; continuous application and availability; and building increasingly rich time series of data
Continuously improving	Learning focused, networked across practitioners and users, testing new approaches, and evolving systems to better manage uncertainty, embrace innovation, and take advantage of emerging opportunities
Embedded	NCA production and use becoming part of the machinery of government and business, building capacity, improving institutional integration for sustainable development, and incorporating NCAs use in procedures and decision-support mechanisms

Transparent and open - the work used publicly available Google Dynamic World AI generated maps of landcover, processed them for change in encroachment landcovers, and made change maps available for citizen science. Citizens participated in improving machine learning methods for nature encroachment classification.

Credible – sampling-based methods to estimate error rates for nature loss classification were estimated using the 'uncertainty audit' approach for ecosystem extent accounts documented by Venter et al. (2024).

Continuously improving – the engagement of civil society in groundtruthing nature encroachment locations using citizen science applications, aims at continuously improving uncertainty estimates with machine learning methods.

In the following, we organize the discussion using a combination of the principles (Ruijs et al. 2019) and uptake criteria (Barton et al. 2022). We first provide a short description of the case study. Next we discuss it in terms of its timeliness, salience (incl. decision-centered, demand-led), credibility and legitimacy (including collaboration, inclusiveness, transparency and openness). In particular, we use the 'salience' criteria to discuss how journalistic methods communicated accounting findings to the general public through different media channels. We finish with a discussion on how this case is an example of communicating plural values associated with ecosystem accounts, and further mainstreaming to increase long term societal impact.

Case study

On January 6th, 2024, The Norwegian Public Broadcasting Corporation (NRK) published an article entitled "Norway in Red White and Grey", illustrating how during the last 5 years Norway has lost on average 79 m^2 of nature per minute, or 208 km^2 in total (Figure 1; NRK 2024). This overall rate of nature encroachment includes the average loss of two soccer fields per day of nature determined as "particularly valuable" according to national government guidelines expectations for regional and municipal planning.

In a matter of a few days the story became one of NRK's top ten most read online news items in the institution's history. By May the story has been read more than 1 million times (Nyborg Støstad 2024). (Norway's population is about 5 million.) The combined press coverage by NRK in digital newspapers and television, and other media that followed the first story, led to a step-change in public debate in 2024 on the urgency for

Figure 1 "Norway in Red White and Grey. NRK reveals: 44.000 interventions in Norwegian nature in five years" was the running title of the online news. The illustration shows a mosaic of nature loss areas representing about 3% of the total area lost in the 5 year period 2018-2022

action, supported by knowledge in ecosystem accounts, particularly at local project and municipal level.

Mads Nyborg Støstad and journalist colleagues at NRK worked in collaboration with researcher Zander Venter at the Norwegian Nature Research Institute (NINA) to map all nature encroachments in Norway over the past five years using Google called Dynamic World's maps generated using artificial intelligence (AI). Using a convolutional neural network model for image recognition Google Dynamic World shows AI classified satellite imagery in maps of nine landcover categories. The use of artificial Intelligence in mapping nature encroachment was consistently reported in the media as a key characteristic of the study. Venter developed an app to download over 40,000 satellite images from Dynamic World, and used time series analysis to detect instances where cleared or built-up land had replaced other land cover types. To validate the map, NINA selected a stratified random sample of 4000 locations . The NRK team then verified 500 of these images via orthophotos using a protocol tested by Venter et al (2024). NRK also checked the 1000 largest areas of encroachment. The rest of the sample was reviewed for different types of journalistic relevance. NRK also verified several random samples that they selected themselves, for instance to find a margin of error for building in reindeer areas (a "particularly valuable" nature type). The uncertainty audit revealed a false positive rate for nature loss pixels of 18% and the resulting area estimate from the map of 208 km^2 accounted for this bias. The nature loss estimate is conservative as Google Dynamic World does not identify e.g. landcover changes such as forest roads, wind power roads or logging, nor changes under water.

Timeliness

Why was the timing right for the NRK piece "Norge i Rødt Hvitt og Grått" about the bit-by-bit encroachment of nature in Norway? The Kunming-Montreal Global Biodiversity Framework (GBF) agreement on a Biodiversity Plan was signed in December 2022. A number of science-policy reports by the Intergovernmental Panel, and National Official Reports since then have cited statistics on national and global nature loss. The NRK news stories coincided with the publication of the National Official Report "In collaboration with Nature" (NOU, 2024) promising a further Government Action Plan for Nature to be published during 2024 (St.mld. 2024) to implement the GBF in Norway.

The inspiration for the story had started with the NRK journalist back in January 2022. The NRK journalists work for a small unit called "Digital Storytelling", looking for national news that could be told using new digital journalism methods. The lead journalist - Mads Støstad Nyborg - was triggered by a news item written in 2020 reporting that the real destruction of Norwegian Nature is unknown. " Norwegian nature is disappearing bit-by-bit without us having an overview of the destruction warn several experts" (NRK 2020) (Figure 2). In this article, experts warned that Norwegian nature was disappearing incrementally without there being a national overview of the loss, effectively arguing for accounting for natural capital at national level.

The NRK journalists contacted a number of national public authorities, agencies and research institutions to find out whether anyone had maps covering the whole of Norway documenting nature loss in a consistent way. After some searching they found NINA researcher Zander Venter who offered to provide an approach based on publicly available Copernicus satellite data classified by Google Dynamic World, connected to historical orthophotos available on Norway National Mapping Agency (Kartverket).

– De reelle ødeleggelsene av norsk natur er ukjent

Norsk natur forsvinner – bit for bit. Uten at vi har nok oversikt over ødeleggelsene, varsler flere eksperter.

NATUR FORSVINNER: Eksperter mener det går en grense for hvor mange inngrep vi kan ha i norsk natur.

Figure 2 "The real destruction of Norwegian Nature is unknown", NRK digital story May 2020

Figure 3 Oppsynsmannen - "The inspector" - a documentary on nature loss hosted by comedian Bård Tufte broadcast January 2024
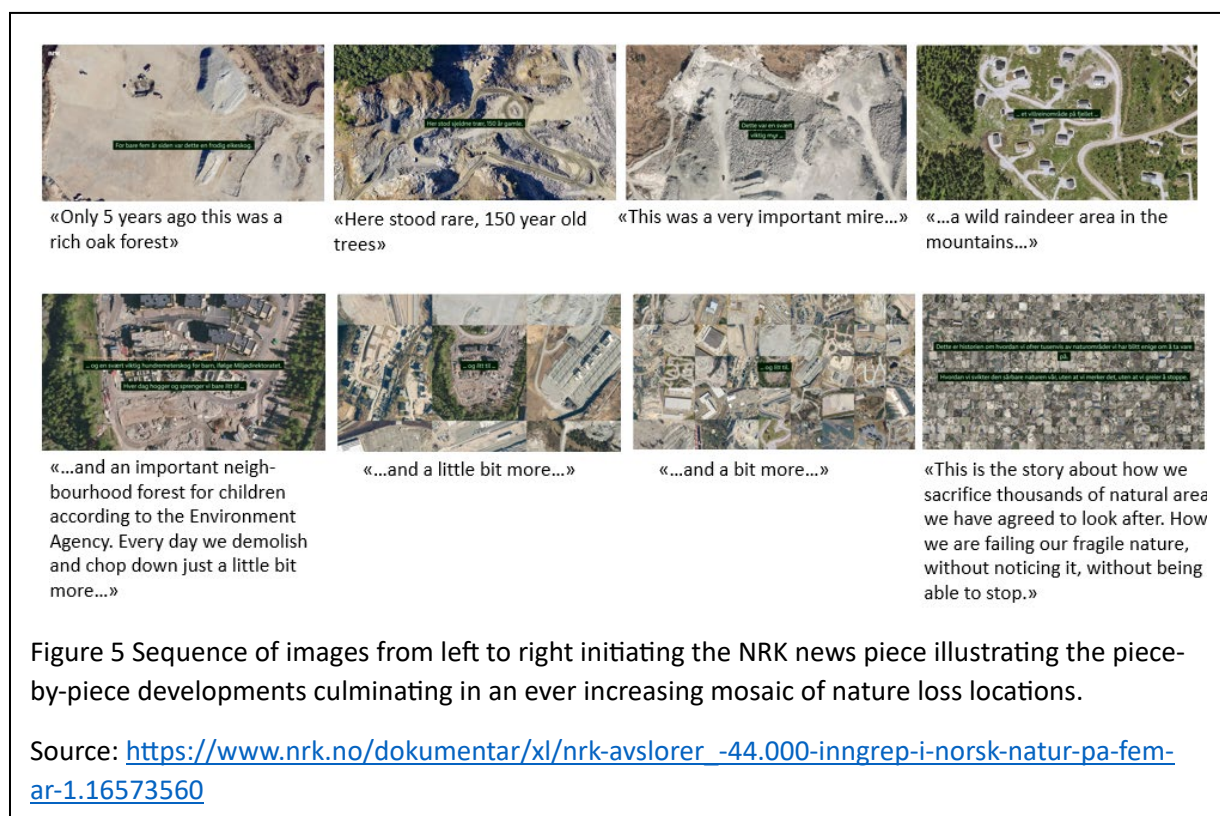

Her er Norges største natur-inngrep

Over hele landet bygges naturen ned. For første gang kan du nå se hvor i ditt distrikt mest natur har gått tapt.

Dette er noen av de største inngrepene NRKs kartlegging har avdekket. Se før/etter-bilder og les om hvert enkelt inngrep lengre ned i saken.

FOTO: NORGE I BILDER / KARTVERKET

Figure 4 "Here are Norway's largest encroachments in nature", NRK digital news 30th January 2024

NRK simultaneously broadcast a 4 part television documentary in January 2024 after release of the news story, called "Oppsynsmannen" (roughly translated as "The nature inspector" in Norwegian). It is hosted by popular comedian Bård Tufte (Figure 2). Tufte visits major construction sites across the country as identified in the nature encroachment mapping, interviewing people affected by the loss of their local nature, developers, local politicians and researchers. Towards the end of January and the airing of the TV documentary , NRK released a follow-up digital story "*Here are Norway's largest encroachments on nature*"(NRK 2024b) (Figure 3). It reported that "*over the whole country nature is being built on. For the first time you can see where most nature is being lost in your district*." In the online news item readers can scroll to their county to find the largest nature encroachment sites illustrated with historic orthophotos. The article also provides a link to a NINA webpage[1] with access to a Google Earth Engine app[2] where the public can zoom in to familiar local areas and help to verify encroachments. NRKs timing of simultaneous coverage in different media of the nature encroachment accounting explains in part the popular reach of the news.

Salience

What journalism methods did NRK use to make the nature encroachment accounting results stand out so sharply in the news early in 2024? The digital narrative starts with a sequence of images showing individual locations of nature encroachment using orthophotos (Figure 5). After 5 locations showing loss of different nature types, the visuals transition to ever increasing mosaic illustrations of the piece-by-piece developments, summing to ever larger areas. This is an unusual journalistic approach as a standard 'hook' would be to create personal interest through the story of a particular

Figure 5 Sequence of images from left to right initiating the NRK news piece illustrating the piece-by-piece developments culminating in an ever increasing mosaic of nature loss locations.

Source: https://www.nrk.no/dokumentar/xl/nrk-avslorer_-44.000-inngrep-i-norsk-natur-pa-fem-ar-1.16573560

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[11] https://www.nina.no/Om-NINA/Aktuelt/Nyheter/article/viser-nedbygging-av-naturen-ved-hjelp-av-fugleperspektiv-og-kunstig-intelligens
[2] https://nina.earthengine.app/view/nedbygging

person. Here personal interest is created by using orthophotos connecting to people's grief at loss-of-place, so-called "solastalgia" (Galway et al. 2019).

This reporting connecting to individuals' sense of place also connects to universal values of dignity, compassion and fairness. The combination of orthophoto zoom to individual encroachments, with a national map showing all the 44.000 encroachment sites of the last 5 years, helping to connect individual loss to collective loss. In fact, merely mapping nature encroachment sites over 5 years as individual points, combines to draw and outline of Norway as a country as illustrated in Figure 6. This story of aggregate unintentional nature loss contrasts with the title of the news piece: "Norway in Red White and _Grey_" - Norway in Red White and _Blue_" is a well-known song practiced by school children and sung Norway's on Constitution Day, the 17th of May. It refers to our national identity being tied to the spectacular colours of Norwegian nature. In this way the reporting creates a dissonance between Norwegians' dignity as a nature loving people and what we collectively, albeit unintentionally, are responsible for destroying.

Further methods include animations to help visualize the national nature encroachment rate of 79 m^2/minute (Figure 7). When readers reach the end of the story a calculator show the cumulative nature loss during the time it took them to read the online article. Nature encroachment is also reported in terms of popular equivalents such as 1 football pitch / hour.

Further into the story personal accounts of loss-of-place, include quotes from children who will lose their local forest to housing development (Figure 8). "*They are going to dig up the forest to make more houses, Casper 10 years old says. "Then we can't play here anymore*". Other personal accounts include a pensioner mourning the loss of local trout streams to motorway construction, and field biologist visiting the site of a commercial development zone where 500.000m^2 forest had been cleared in a forest they surveyed for the EIA. The piece also interviews developers and contractors who present their case for the loss of nature as necessary for the economic development of local communities, arguing that mitigation hierarchy measures have been taken in accordance with EIA regulations. This balance in the reporting also contributes to the credibility of the journalism.

Figure 6 Map overview of 44.000 nature loss sites
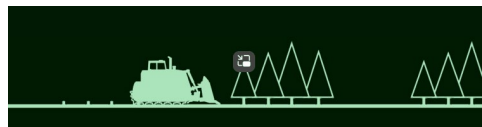
Figure 7 Animation showing the rate of loss (79 m2/minute)

Vi møtte unge og gamle. Her på Bunestoppen i Bamble kommer ikke barna inn i skogen sin lenger, for noen har bestemt at den skal sprenges.

«De skal grave opp skogen og lage flere hus», sier Casper på ti år. «Da kan vi ikke leke her mer.»

Figure 8 Children losing their local forest

The article then asks the question whether the 208 km^2 of overall nature encroachment accounted for in 5 years was not a necessary result of development. The story continues by revealing that this figure includes the equivalent of 2 football pitches per day "particularly valuable" nature types. NRK revealed that 10 new building sites per day were being opened in such "particularly valuable" nature. The article defines "valuable nature" as those nature types that the last 3 governments of prime ministers Stoltenberg, Solberg and Støre have called on regional and municipal governments to
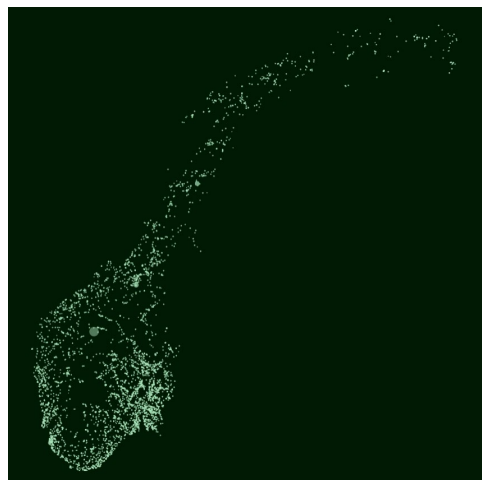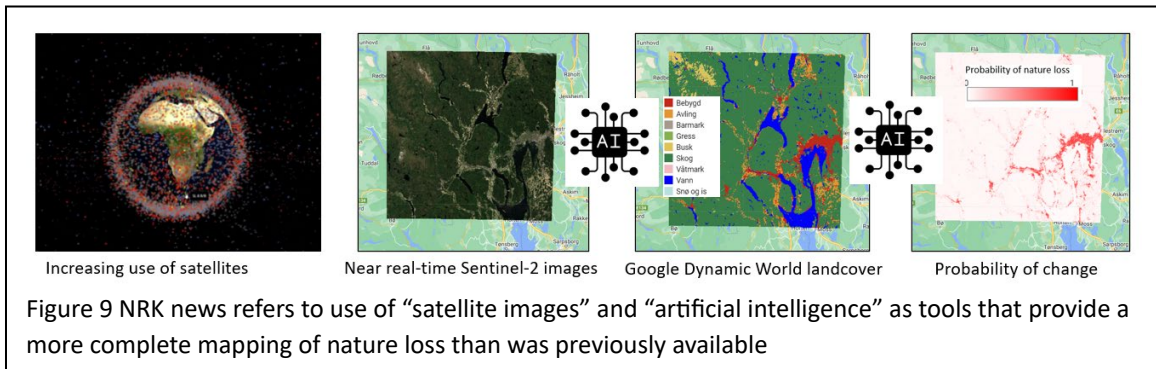
protect in their master and zoning plans. This includes wilderness, red listed nature types, mires, wild reindeer habitat, riparian nature and coastal zones in high population density areas. The loss of these nature types is particularly salient because – as the NRK journalists argue - our democratically elected national governments have repeatedly called for their protection, but our locally elected politicians, local administrations, and indeed all of us collectively have failed to protect them. In 2008 and 2012 the Norwegian Auditor General criticized the government for not protecting and not having an overview of the loss of this particularly valuable nature, in contradiction with adopted government policy (Nybor Støstad et al. 2024).

Credibility

Increasing use of satellites   Near real-time Sentinel-2 images   Google Dynamic World landcover   Probability of change

Figure 9 NRK news refers to use of "satellite images" and "artificial intelligence" as tools that provide a more complete mapping of nature loss than was previously available

A remarkable feature of the public discourse in the aftermath of the NRK story, was the almost total absence of technical or scientific critique of the extent accounting research behind the story. Why was the satellite data and AI generated mapping perceived as credible? Why did the uncertainty in the big data and artificial intelligence not discredit the science?

A number of journalistic methods were combined with extent accounts and documentation of the statistical methods the NRK journalists and NINA researcher used. Pop-up windows providing further definitions and documentation explained the map layers used to account for encroachment and valuable nature types.

Venter used multiple AI generated Google Dynamic World maps of landcover to compute encroachment maps (Figure 9). NRK refers in most of its reporting to use of "satellite images" and "artificial intelligence" as tools that provide a more complete mapping of nature loss than was previously available. Google Dynamic World[3] AI-based[4] maps still contain errors due false positive rate for identifying nature loss (Figure 10). Pop-up windows explain that encroachment pixels have a false positive rate of almost 1/5 (18%) as determined by the uncertainty audit methods. Although not reported in the NRK article the nature encroachment rate of 208 km^2 in 5 years is within the range of Statistcs Norway's cadastre based estimates
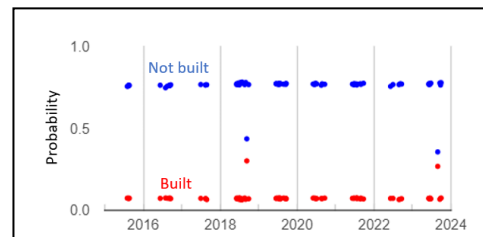

Figure 10 Google Dynamic World AI computes probabilities of landcover with 18% false positive rate for identifying nature loss
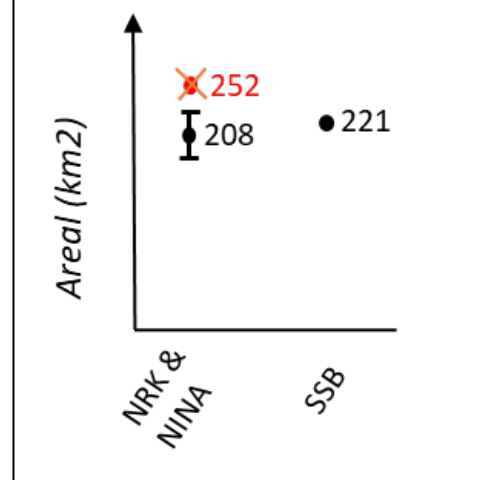

Figure 11 NRK&NINA reported nature loss of in 5 years (208 km2) produces similar results to SSB cadastre based approach (221 km2) and is more conservative than pixel counting (252 km2)

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[3] https://dynamicworld.app/

[4] Google Dynamic World uses convolutional neural network (CNN). Convolution-based networks are the de-facto standard in deep learning-based approaches to computer vision and image processing. Convolutional neural network - Wikipedia

(221 km^2). It is more conservative than the estimate of 252 km^2 that would result from the common ecosystem accounting method of "pixel counting" (Figure 11).

Legitimacy

NRK is Norway's oldest broadcasting organisation. It is perceived as a legitimate source of news, with 82% of the population stating they trust the organization's reporting[5]. This constitutes a solid platform for nationwide science communication on the nature crisis. Further aspects reinforcing the 'legitimacy' of NRK reporting on nature loss include collaboration, inclusiveness, transparency and openness, which we discuss in turn below.

Collaboration. NRK collaborated with NINA, using published ecosystem accounting and uncertainty audit methods (Venter et al. 2024). Using a spreadsheet with encroachment coordinates generated by Venter, NRK journalists used the public map service Norgeibilder.no to verify a sample of almost 500 encroachment sites using historic orthophotos to generate false positive error estimates (Figure 12). The co-production of the uncertainty estimates with journalists lead to the NRK team having in-depth knowledge of individual encroachment sites. This in-depth understanding supported follow-up investigative journalism on i.a. large encroachment sites where EIA regulations had not been followed or municipal politicians had ignored documentation of nature values. It is noteworthy that NRK data journalists developed the loss accounts for valuable nature, querying national GIS datasets using code they developed in-house.
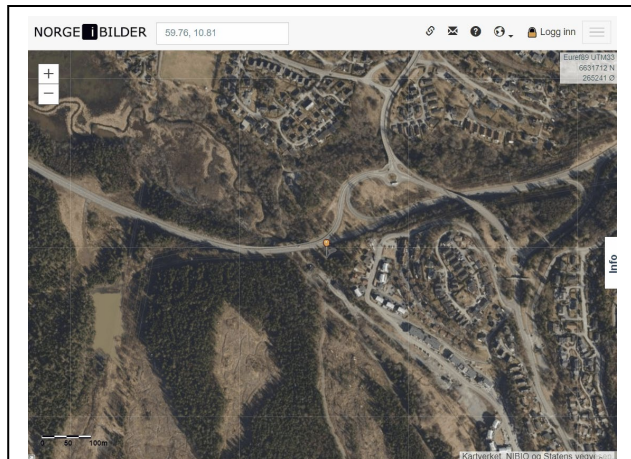
Inclusiveness. NINA researcher

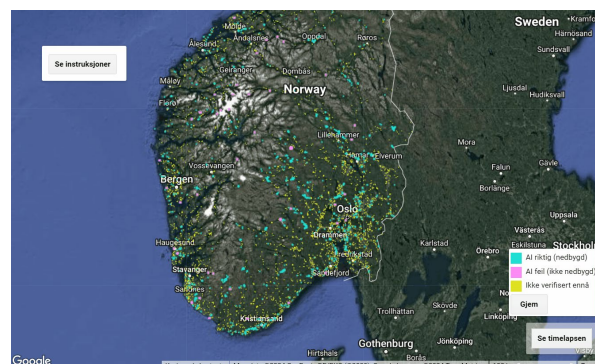Figure 12 NRK journalists verified 500 orthophotos to generate false positive error estimates

Figure 13 NINA Research Z. Venter made the verification app used by journalists available to public citizen science participation via a follow-up NRK news piece and NINA landing page

Figure 14 Verify the largest nature loss sites in your district in NRK follow-up news piece

Venter made a version of the verification app that was used by NRK journalists available to public

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[5] https://www.nrk.no/informasjon/hog-bruk-og-tillit-i-eit-uroleg-ar-1.16385007. By contrast 44% of Britons said they considered BBC trustworthy or very trustworthy.

citizen science participation via a follow-up NRK news piece (NRK 2024b)(Figure 14). In the first two months after publication around 26000 verifications had been made of roughly 9000 locations, representing 125 km2 of potential encroachment areas. This data is being used by Venter to improve the uncertainty estimates of the encroachment accounts.

Transparency and openness. The population was given interactive access to remote sensing based maps normally only available to technical specialists in research institutions and geodata agencies. Since publication NRK journalists have received over 2000 e-mails with about 1000 tips from citizens around the country concerning nature encroachment (Nyborg Støstad 2024). These were more tips than could be followed up by NRK journalists, but resulted in e.g. further revelations of large development plans to build on locations with red list species, cultural heritage sites and productive agriculture soil – all protected landscape features ignored by local planners in approving regulation plans (NRK 2024a).   In the weeks following publication of the first news story NRK shared their database on encroachment sites with 62 local newspapers around Norway, leading to further local investigative journalism locally.   Currently, NINA has a project to develop mobile applications to make digital maps on nature encroachment and valuable nature available to younger nature inspectors in nature conservation organisations around the country.

Policy uptake and mainstreaming

The NRK case "Norway in Red, White and Grey" was successful in communicating plural values of nature using journalistic methods, based on simple biophysical extent accounts of nature encroachment. The case study demonstrates that in communicating ecosystem accounts to civil society, the public and politicians a plural value perspective is possible and impactful (Figure 15).
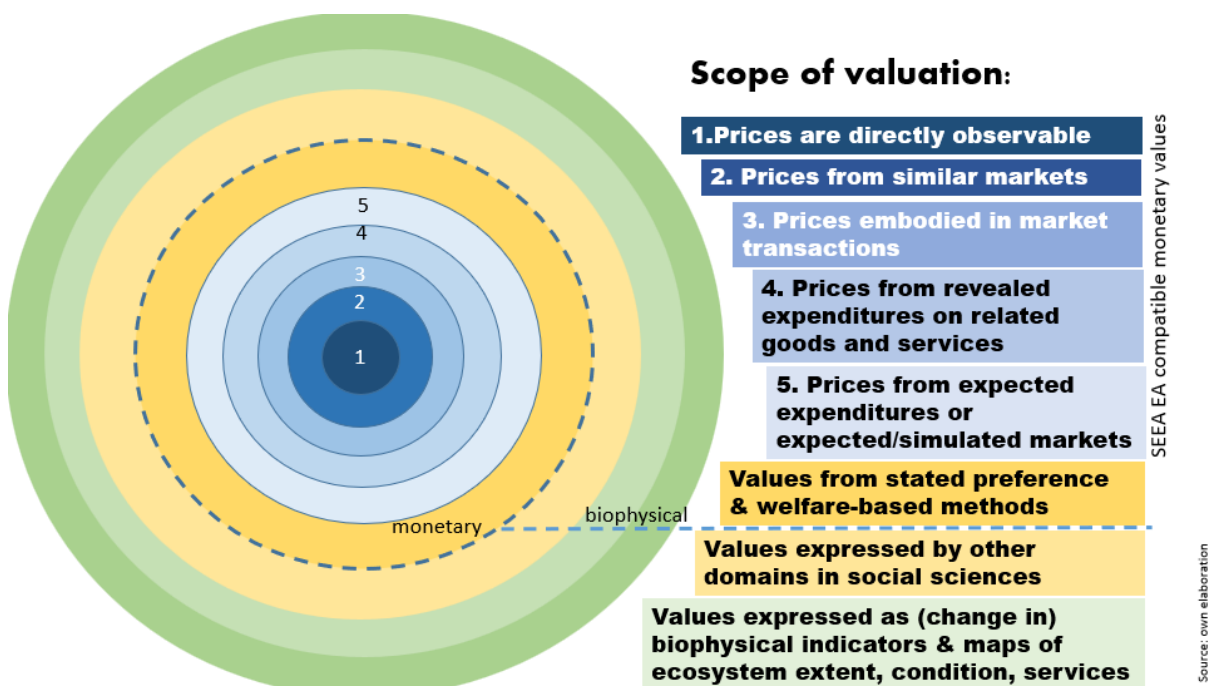

Figure 15. The NRK case Norway in Red, White and Grey communicated plural values of nature using journalistic methods, based on simple biophysical extent accounts. Source: adapted from Barton et al. (2019)

What will be the long-term policy uptake of this reporting of extent account data?   The NRK publication of accounting data was decision-centered in highlighting the lack of consistent natural capital mapping and accounting methods at the national level in Norway.   This was a 'demand-led' compilation and communication of accounting data. However, the demand did not come from public

authorities. Journalists worked to publicize a knowledge gap that had been identified by researchers several years earlier, but had achieved little traction with national politicians and agencies.

The publication has been referred to as "turning point for nature in Norway" with evidence of uptake and societal impact expressed in several ways (Nybor Støstad et al. 2024): 1800 newspaper articles in 2024 point to NRKs publications linked to "Norway in Red, White and Grey"; NRK shared 131 local version of the NRK encroachment database with 62 local newspapers; municipal politicians say to NRK they have started to vote differently in planning issues; parties on both sides of the political divide in Norway report a "mood shift" in Parliament with it now being easier to approve plans to protect nature; the director of the national Climate and Environment Agency's credited media attention on nature encroachment with the fact that 83 municipalities in March 2024 reporting that they are carrying out complete revisions of their old zoning plans in order to protect more nature

After NRKs reporting on nature encroachment, the minister of climate and the environment recently acknowledged the importance of the reporting and that the government was tripling support for ecosystem accounting in next year's budget to 50 million NOK**.** Improving ecosystem accounting is seen as the main tool for reducing nature loss in Norway in the government's recent white paper (St.mld. 2024). On the other hand nature conservation organisations and researchers have been critical to the government's focus on accounting as a policy rather than a tool (Indseth et al. 2024).

Conclusions

Taking a step back we can view the collaboration between the national broadcaster NRK and NINA on simple nature encroachment accounting as far from the SEEA EA standards, and further still from its main purpose of documenting the economic importance of ecosystem services for the national economy. However, the perfect can easily become the enemy of the good. Norway does not plan to publish ecosystem accounts until 2026 by which time, if the 5 year trend continues, a further 125 km^2 of Norwegian nature will have been lost to encroachment since publication early 2024. Furthermore, NRK decided to develop simple accounts for "particularly valuable" nature types - in some, but not all cases the same as ecosystem types – identified by 3 consecutive Prime Ministers on both sides of the Parliament as national policy priorities for conservation. In SEEA EA terminology, this case study shows that timely, thematic policy-focused accounting approach have high political salience.   The case study shows that plural values of nature can be communicated to policy-makers through simple biophysical extent accounts when these are thematically policy-targeted. The case shows how plurcal values of nature and universal values such as dignity, compassion and fairness were communicated through journalistic methods in collaboration with simple but timely, salient, credible and legitimate accounting knowledge.

References

Barton, David N, A. Caparrós, N. Conner, B. Edens, M. Piaggio, and J. Turpie. 2019. "Discussion Paper 5.1: Defining Exchange and Welfare Values, Articulating Institutional Arrangements and Establishing the Valuation Context for Ecosystem Accounting. Paper Drafted as Input into the Revision of the System on Environmental-Economic Accounting 2012–Experimental Ecosystem Accounting. Version of 25 July 2019. Https://Seea.Un.Org/Sites/Seea.Un.Org/Files/Documents/EEA/Discussion_paper_5.1_defining_values_for_erg_aug_2019.Pdf," 107.

Barton, David N., Rebecca Chaplin-Kramer, Elena Lazos Chavero, Meine Van Noordwijk, Stefanie Engel, Alexander Girvan, Thomas Hahn, et al. 2022. "Chapter 4. Value Expression in Decision-Making." Zenodo. https://doi.org/10.5281/zenodo.7701884.

Dickie, Ian, and Sophie Neupauer. 2019. "Natural Capital Accounts: Nations and Organizations." *Journal of Environmental Economics and Policy* 8 (4): 379–93. https://doi.org/10.1080/21606544.2019.1639219.

Galway, Lindsay P., Thomas Beery, Kelsey Jones-Casey, and Kirsti Tasala. 2019. "Mapping the Solastalgia Literature: A Scoping Review Study." *International Journal of Environmental Research and Public Health* 16 (15): 2662. https://doi.org/10.3390/ijerph16152662.

Hein, Lars, Kenneth J. Bagstad, Carl Obst, Bram Edens, Sjoerd Schenau, Gem Castillo, Francois Soulard, et al. 2020. "Progress in Natural Capital Accounting for Ecosystems." *Science* 367 (6477): 514–15. https://doi.org/10.1126/science.aaz8901.

Hein, Lars, Roy P. Remme, Sjoerd Schenau, Patrick W. Bogaart, Marjolein E. Lof, and Edwin Horlings. 2020. "Ecosystem Accounting in the Netherlands." *Ecosystem Services* 44 (August):101118. https://doi.org/10.1016/j.ecoser.2020.101118.

Indseth, M., Gro Sandkjær Hansen, Bart Immerzeel, and David N. Barton. 2024. "Natural Capital Accounts Are Only a Tool (Naturregnskap Er Bare et Redskap)." *Morgenbladet*, February 22, 2024.

IPBES. 2022. *Summary for Policymakers of the Methodological Assessment of the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. U. Pascual et al. (Eds)*. Bonn, Germany: IPBES Secretariat. https://zenodo.org/record/6522392.

Maes, Mikaël J. A., Kate E. Jones, Mireille B. Toledano, and Ben Milligan. 2020. "Accounting for Natural Capital Has Cross-Cutting Relevance for UK Public Sector Decision-Making." *Ecosystem Services* 44 (August):101127. https://doi.org/10.1016/j.ecoser.2020.101127.

NOU. 2024. "In Collaboration with Nature (I Samspill Med Nature)." Norsk Offentlig Utredning (Norwegian Official Report) 2024:2.

NRK. 2020. "The Real Destruction of Norwegian Nature Is Unknown (Norwegian)," May 4, 2020. https://www.nrk.no/klima/slik-forsvinner-norsk-natur-_-bit-for-bit-1.14985837.

———. 2024a. "¨The Story of the Encroachment in VIken Parl," June 8, 2024. https://www.nrk.no/dokumentar/xl/bindinger_-hogst-og-politikere-som-ikke-ante-hva-de-stemte-pa_-historien-om-inngrepet-pa-viken-park-1.16882702.

———. 2024b. "Here Are Norway's Largest Nature Encroachments," January 30, 2024. https://www.nrk.no/dokumentar/her-er-norges-storste-naturinngrep-1.16689009.

———. 2024c. "Norway in Red, White and Grey.," January 6, 2024. https://www.nrk.no/dokumentar/xl/nrk-avslorer_-44.000-inngrep-i-norsk-natur-pa-fem-ar-1.16573560.

———. 2024d. "The Govenrment Gives 50 Million for a New Nature Map," September 1, 2024. https://www.nrk.no/dokumentar/regjeringen-gir-50-millioner-til-naturkart-etter-nrks-avsloringer-1.17023767.

Nybor Støstad, Mads, Ruben Solvang, Su Thet Mon, and Anne Linn Kumano-Ensby. 2024. "NRK Metoderapport Data-Skup 2024. Norge i Rødt, Hvitt of Grått."

Nyborg Støstad, Mads. 2024. "How NRK Used Artificial Intelligence to Map 44.000 Nature Encroachments." In . https://www.youtube.com/watch?v=Nrs0_B8d6X0.

Pascual, Unai, Patricia Balvanera, Christopher B. Anderson, Rebecca Chaplin-Kramer, Michael Christie, David González-Jiménez, Adrian Martin, et al. 2023. "Diverse Values of Nature for Sustainability." *Nature* 620 (7975): 813–23. https://doi.org/10.1038/s41586-023-06406-9.

Ruijs, Arjan, Michael Vardon, Steve Bass, and Sofia Ahlroth. 2019. "Natural Capital Accounting for Better Policy." *Ambio* 48 (7): 714–25. https://doi.org/10.1007/s13280-018-1107-y.

St.mld. 2024. "Bærekraftig Bruk Og Bevaring Av Natur — Norsk Handlingsplan for Naturmangfold Meld. St. 35 (2023–2024)." https://www.regjeringen.no/no/dokumenter/meld.-st.-35-20232024/id3054780/.

United Nations. 2021. "System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA). White Cover. Available at: Https://Seea.Un.Org/Ecosystem-Accounting."

https://unstats.un.org/unsd/statcom/52nd-session/documents/BG-3f-SEEA-EA_Final_draft-E.pdf.

Venter, Zander S., Bálint Czúcz, Erik Stange, Megan S. Nowell, Trond Simensen, Bart Immerzeel, and David N. Barton. 2024a. "'Uncertainty Audit' for Ecosystem Accounting: Satellite-Based Ecosystem Extent Is Biased without Design-Based Area Estimation and Accuracy Assessment." *Ecosystem Services* 66 (April):101599. https://doi.org/10.1016/j.ecoser.2024.101599.

———. 2024b. "'Uncertainty Audit' for Ecosystem Accounting: Satellite-Based Ecosystem Extent Is Biased without Design-Based Area Estimation and Accuracy Assessment." *Ecosystem Services* 66 (April):101599. https://doi.org/10.1016/j.ecoser.2024.101599.

Venter, Zander S., Bálint Czúcz, Erik Stange, Megan S. Nowell, Trond Simensen, Bart Immerzeel, and David N. Barton. 2024. "'Uncertainty Audit' for Ecosystem Accounting: Satellite-Based Ecosystem Extent Is Biased without Design-Based Area Estimation and Accuracy Assessment." *Ecosystem Services* 66 (April): 101599. https://doi.org/10.1016/j.ecoser.2024.101599.