

BRIEF 3 LOG SHEET: Measures to increase ecosystem resilience and avoid tipping points

IEEP was contracted by the Royal Belgian Institute of Natural Sciences (RBINS)/Belgian Science Policy Office (BelSPO) on behalf of BiodivERsA to produce a series of policy briefs based on the results of research projects funded by the BiodivERsA calls 2010-2011, 2011-2012 and 2012-2013, and the joint BiodivERsA FACCE JPI call 2013-2014, as well as other EU-funded research projects where relevant.

Knowledge and methodology used

The Policy Brief “Measures to increase ecosystem resilience and avoid tipping points” is based on the scientific results of three projects funded by the BiodivERsA network (listed below). The Brief extracts and summarizes some key results of the projects and provides a list of relevant policy recommendations linked to current EU policy processes.

The Brief was drafted by the Institute for European Environmental Policy (IEEP), in consultation with the BiodivERsA Policy briefs Working Group (lead by BelSPO), and with researchers from the respective projects.

The project team of IEEP initially consulted all relevant BiodivERsA project reports from the relevant time period (2010-2014) as supplied by the BiodivERsA secretariat. Some potentially interesting project findings were identified from these reports and the IEEP team then identified the most relevant peer-reviewed scientific articles produced by the projects. Project leaders and researchers were then contacted to request additional publications and project findings. All sources used are listed below.

The LINKTREE project report was also consulted but not used in the briefing.

Quality control and validation was done by all parties (co-authors) involved:

IEEP Project team

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Sources of information consulted for key research findings

Project reports used :

EC21C BiodivERsA Project Final Report

TIPPINGPOND BiodivERsA Project Final Report

TIPTREE BiodivERsA Project Final Report

Peer-reviewed scientific publications used:

Morin, X, Fahse, L, de Mazancourt, C, Scherer-Lorenzen, M, Bugmann, H (2014). *Temporal stability in forest productivity increases with tree diversity due to asynchrony in species dynamics*. Ecology Letters No 17(12): 1526–1535. <http://dx.doi.org/10.1111/ele.12357> (EC21C)

Oddou-Muratorio, S and Davi, H (2014). *Simulating local adaptation to climate of forest trees with a Physio-Demo-Genetics model*. Evolutionary Applications No 7(4), 453-467. <http://dx.doi.org/10.1111/eva.12143> (TIPTREE)

García-Valdés, R, Bugmann, H, Morin, X (2018). *Climate change-driven extinctions of tree species affect forest functioning more than random extinctions*. Diversity and Distributions 00:1–13. <https://doi.org/10.1111/ddi.12744> (EC21C)

Lemmens, P, Mergeay, J, Van Wichelen, J, De Meester, L and Declerck, S A (2015). *The impact of conservation management on the community composition of multiple organism groups in eutrophic interconnected man-made ponds*. PLoS ONE No 10 (9), e0139371. <https://doi.org/10.1371/journal.pone.0139371> (TIPPINGPOND)

Vanacker, M, Wezel, A, Payet, V, Robin, J (2015). *Determining tipping points in aquatic ecosystems: The case of biodiversity and chlorophyll a relations in fish pond systems*. Ecological Indicators No 52: 184–193. <http://dx.doi.org/10.1016/j.ecolind.2014.12.011> (TIPPINGPOND)

Vanacker, M, Wezel, A, Arthaud, F, Guérin, M and Robin, J (2016). *Determination of tipping points for aquatic plants and water quality parameters in fish pond systems: A multi-year approach*. Ecological Indicators No 64, 39-48. <https://doi.org/10.1016/j.ecolind.2015.12.033> (TIPPINGPOND)

Wezel, A & Robin, J (2015). Fish Pond Toolkit. ISARA-Lyon – AGRAPOLE, Lyon.
<https://bio.kuleuven.be/eeb/ldm/tippingpond/documents/fish-pond-toolkit.pdf> (TIPPINGPOND)

Other research findings were consulted to evaluate the generality of the BiodivERsA research findings, but have not been cited in the policy brief itself. Key papers include:

- Verbeek, L, Vanhamel, M, van den Berg, E, Hanashiro, F T T, Gianuca, A T, Striebel, M, Lemmens, P, Declerck, S A J, Hillebrand, H, De Meester, L (in preparation). *High temporal species turnover and functional consequences of environmental change in Belgian farmland ponds*. Submitted to Freshwater Biology. (TIPPINGPOND)
- Fady, B, Cottrell, J, Ackzell, L, Alia, R, Muys, B, Prada, A, González-Martinez, S C (2016). *Forests and global change: what can genetics contribute to the major forest management and policy challenges of the twenty-first century?* Regional Environmental Change 16(4), 927-939. <http://dx.doi.org/10.1007/s10113-015-0843-9>
- Reyer, C P et al. (2015). *Forest resilience and tipping points at different spatio-temporal scales: approaches and challenges*. Journal of Ecology No 103 (1), 5-15.
- Jucker et al (2014). *Stabilising effects of diversity on aboveground wood production in forest ecosystems: linking patterns and processes*. Ecology Letters No 17(12): 1560–1569. <http://dx.doi.org/10.1111/ele.12382>
- Newton (2016). *Biodiversity risks of adopting resilience as a policy goal*. Conservation Letters No 9(5): 369-376. <http://dx.doi.org/10.1111/conl.12227>
- Stockholm Resilience Centre Research Insights 2 Regime Shifts. Social-ecological systems contain various tipping points or thresholds that can trigger large-scale reorganization. http://www.stockholmresilience.org/download/18.3e9bddec1373daf16fa438/1459560363336/Insights_regimeshifts_120111-2.pdf

Sources of information consulted for policy recommendations:

Forest genetic resources conservation:

- Information held by IEEP on the implementation of the CAP Rural Development Programme forestry measures.
- Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005. Official Journal of the European Union L347, pp487-548. 17/12/2013. Article 34 Forest-environmental and climate services and forest conservation (measure 15)
- Lefèvre, F, Koskela, J, Hubert, J, Kraigher, H, Longauer, R, Olrik, D C, Schüller, S, Bozzano, M, Alizoti, P, Bakys, R, Baldwin, C, Ballian, D, Black-Samuelsson, S, Bednarova, D, Bordács, S,

Collin, E, De Cuyper, B, De Vries, S M G, Eysteinnsson, T, Frydl, J, Haverkamp, M, Ivankovic, M, Konrad, H, Koziol, C, Maaten, T, Notivol Paino, E, Öztürk, H, Pandeva, I D, Parnuta, G, Pilipovič, A, Postolache, D, Ryan, C, Steffenrem, A, Varela, M C, Vessella, F, Volosyanchuk, R T, Westergren, M, Wolter, F, Yrjänä, L and Zarina, I (2013). *Dynamic conservation of forest genetic resources in 33 European countries*. Conservation Biology No 27 (2), 373-384.
<http://dx.doi.org/10.1111/j.1523-1739.2012.01961.x>

- COST Action FP1202 Policy Brief Marginal and peripheral forests: a key genetic resource for enhancing the resilience of European forests to global change.

Pond conservation and management:

- Joint Research Centre database on GAEC 2014 & 2015
- European Commission (2012) Guidance on Aquaculture and Natura 2000.
<http://ec.europa.eu/environment/nature/natura2000/management/docs/Aqua-N2000%20guide.pdf>

Interviews carried out

- Dr Bruno Fady, LINKTREE and TIPTREE projects, 29th March 2017
- Dr Xavier Morin, EC21C project, 10th April 2017
- Dr Pieter Lemmens, TIPPINGPOND project, 24th April 2017

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