

Lisa 4. Kirjanduse ülevaade (artiklid, raamatud), milles on kasutatud metsaökosüsteemi seisundi indikaatoreid riiklike seirete põhjal. NB loetelu ei pruugi olla täielik.

Varasemad uuringud või teadusartiklid indikaatori põhjal. Indikaatori kasutamine siseriiklikes või rahvusvahelistes aruannetes.

Metsaresurss

Iga-aastane Aastaraamat Metts.

Metsanduse arengukavade jaoks tehtavates analüüsides kasutatakse SMI andmeid.

Indikaatori/te kasutamine rahvusvahelises aruandluses:

Iga-aastane LULUCF raport.

Iga viie aasta järel FRA raport.

Metsatervis

Karoles, K. 1991. Metsade seisund, State of forests. – Keskkond 1991, Estonian Environment 1991. Environmental Report 4. Environment Data Centre, National Board of Waters and the Environment. Helsinki, p. 8–10.

Sepp, R. Asi, E. 1994. Metsamuldade seire ülesanded ja esialgsed tulemused. – Kaasaegse ökoloogia probleemid. Alalhoidlik areng ja looduskeskne elulaad. Eesti VI ökoloogiakonverentsi lühiartiklid, Tartu, 24.–26. aprill 1994. Tartu, lk. 125–128.

Terasmaa, T. 1994. Eesti metsade tervisliku seisundi muutustest viimastel aastatel. – Kaasaegse ökoloogia probleemid. Alalhoidlik areng ja looduskeskne elulaad. Eesti VI ökoloogiakonverentsi lühiartiklid, Tartu, 24.–26. aprill 1994. Tartu, lk. 59–62.

Pilt, E. 1996. Metsade tervislik seisund, Forest health. – Keskkond 1995, Estonian Environment. Eesti Vabariigi Keskkonnaministeerium, Info- ja Tehnokeskus. Tallinn, lk. 22–23.

Terasmaa, T., Sepp, R., Asi, E. 1996. Eesti metsamuldade uurimise seisund, mõningaid tulemusi ja edasisi ülesandeid. – Eesti teadlaste kongress. 11.–15. augustini 1996. a. Tallinnas. Ettekannete kokkuvõtted. Tallinn, lk. 385.

Terasmaa, T. 1996. Metsaseire (+metsamullad). – Keskkonnaseire 1995. Eesti Vabariigi Keskkonnaministeerium, Info- ja Tehnokeskus. Tallinn, lk. 80.

Karoles, K. 1997. Estonia. – Ten Years of Monitoring Forest Condition in Europe. Studies on Temporal Development, Spatial Distribution and Impact of Natural and Anthropogenic Stress Factors. Federal Research Centre for Forestry and Forest Products. Brussels, Geneva, p. 63–66.

Asi, E., Sepp, R. 1997. 2. National soil condition reports. 2.8. Estonia. – Forest soil condition in Europe. Results of a large-scale soil survey. Reported by: Forest Soil Co-ordinating Centre in co-operation with the Ministry of the Flemish Community. Brussels, Geneva, p. 149–151.

Terasmaa, T. 1997. Metsaseire. – Eesti keskkonnaseire 1996 Estonian Environmental Monitoring. Eesti Vabariigi Keskkonnaministeerium, Info- ja Tehnokeskus. Tallinn, lk. 125–126.

Asi, E., Terasmaa, T. 2000. Deposition monitoring in Estonian Forests. – Crown Condition Assessment in the Nordic Countries. Proceedings from the 5th International ECE/EU Intercalibration Course for Northern Europe on Crown Condition Assessment and SNS *Ad Hoc* Working Group Meeting on Monitoring of Forest Damage, 16th–18th June 1999, Estonia. Tartu, p. 3–6.

Karoles, K., Ōunap, H., Pilt, E., Terasmaa, T., Kivits, H. 2000. Forest Condition in Estonia in 1988-1999, Defoliation and Forest Damages on Level 1 Sample Points. – Crown Condition Assessment in the Nordic Countries. Proceedings from the 5th International ECE/EU Intercalibration Course for Northern Europe on Crown Condition Assessment and SNS *Ad Hoc* Working Group Meeting on Monitoring of Forest Damage, 16th–18th June 1999, Estonia. Tartu, p. 25–28.

Karoles, K., Ōunap, H., Pilt, E., Terasmaa, T., Kivits, H. 2000. Forest condition in Estonia in 1988-1999, defoliation and forest damages on Level 1 sample points. – Metsanduslikud uurimused XXXIII. Tallinn, p. 209–216.

Karoles, K., Ōunap, H., Pilt, E. 2001. Survey of Forest Damage in Estonia. – Methodology of Forest Insect and Disease Survey in Central Europe. Proceedings of the IUFRO Working Party 7.03.10 Workshop September 24–28, 2000, Bușteni, Romania. Brașov, Romania, p. 51–56.

Kaar, E., Kivistö, A., Ōunap, H., Asi, E. 2002. Aidu karjääri puistute kasvukäigu modelleerimine ja seisundi hindamine. – Eesti keskkonnaseire 2001. Tartu Ülikooli Kirjastus, lk. 141–142.

Kõlli, R., Asi, E., Köster, T. 2004. Organic Carbon pools in Estonian forest soils. – Baltic Forestry, vol. 10, no. 1, p. 19–26.

Kõlli, R., Ellermäe, O., Lemetti, I., Asi, E. 2004. Carbon sequestration and humus status of Estonian forest soils. – Eurosoil 2004, p. 1–10.

Karoles, K. 2005. Estonia. – Europe's Forests in a Changing Environment. Twenty Years of Monitoring Forest Condition by ICP Forests. UNECE, Geneva, p. 19.

Pajuste, K., Frey, J., Asi, E. 2006. Interactions of atmospheric deposition with coniferous canopies in Estonia. – Environmental Monitoring and Assessment, vol. 112, p. 177–196.

Asi, E., Ōunap, H. 2008. Metsaseire. – Eesti keskkonnaseire 2004–2006. Keskkonnaministeeriumi Info- ja Tehnokeskus. Tallinn, lk. 89–94.

Asi, E., Napa, Ü., Frey, J. 2009. Concentrations of trace metals in epigeic moss *Hylocomium splendens* and needles in Scots pine and Norway spruce on Estonian ICP Forests sites. – 6th International Symposium on Ecosystem Behaviour BIOGEOMON 2009, Conference Programme & Abstracts. Working Papers of the Finnish Forest Research Institute, no. 128, p. 362.

Kõlli, R., Ellermäe, O., Köster, T., Lemetti, I., Asi, E., Kauer, K. 2009. Stocks of organic carbon in Estonian soil cover. – *Estonian Journal of Earth Sciences*, vol. 58, p. 95–108.

Kõlli, R., Asi, E., Apuhtin, V., Kauer, K., Szajdak, L. 2010. Chemical properties of Histosols' and histic soils' peats in forest lands of Estonia. – *Mires and Peat*, vol. 6, p. 1-12.

Kõlli, R., Asi, E., Apuhtin, V., Kauer, K., Szajdak, L. 2010. Formation of the chemical composition of Histosols and histic soils in the forest lands of Estonia. *Chemistry and Ecology*, vol. 26, no. 4, 289–303.

Laas, E. Muld ja mets. In: Laas, E., Uri, V., Valgepea, M. 2011. *Metsamajanduse alused. Õpik kõrgkoolidele*. Tartu Ülikooli Kirjastus, lk. 120–124. (20 fotot lk. 666–669, autor E. Asi).

Ostonen, I., Helmisaari, H.-S., Borken, W., Tedersoo, L., Kukumägi, M., Bahram, M., Lindroos, A.-J., Nöjd, P., Uri, V., Merilä, P., Asi, E., Lõhmus, K. 2011. Fine root foraging strategies in Norway spruce forests across a European climate gradient. – *Global Change Biology*. vol. 17, issue 12, p. 3620-3632.

Apuhtin, V., Asi, E., Napa, Ü. 2012. Eesti metsade seisund. – *Eesti keskkonnaseire 2007-2010*. Keskkonnateabe Keskus, Tallinn, lk. 163-169.

Astover, A. (koostaja), 2012. *Mullateadus. Õpik kõrgkoolidele*. Eesti Maaülikool, Tartu, 486 lk. (18 fotot, autor E. asi).

Valgepea, M., Apuhtin, V., Adermann, V. 2012. *Metsade seisund. – Eesti Keskkonnanäitajad 2012*. Keskkonnateabe Keskus, Tallinn, lk. 41.

Karoles, K., Ōunap, H., Pilt, E., Apuhtin, V. 2014. Männikute seisundist metsaseire andmetel. – In: Kurm, M. (koostaja) *Mänd Eestis*. Tartu, lk. 355–362.

Napa, Ü., Kabral, N., Liiv, S., Asi, E., Timmus, T., Frey, J. 2014 *Raskmetallide sissekanne okasmetsadesse, peetumised samblarindes ja metsaködus Eesti keskkonnaseire andmete põhjal. – “95 years of Estonian geography”: selected studies: published for the 95th anniversary of the Department of Geography, University of Tartu*, p. 317–329.

Waldner, P., Marchetto, A., Thimonier, A., Schmitt, M., Rogora, M., Granke, O., Mues, V., Hansen, K., Karlsson, G.P., Žlindra, D., Clarke, N., Verstraeten, A., Lazdins, A., Schimming, C., Iacoban, C., Lindroos, A.J., Vanguelova, E., Benham, S., Meesenburg, H., Nicolas, M., Kowalska, A., Apuhtin, V., Napa, U., Lachmanová, Z., Kristoefel, F., Bleeker, A., Ingerslev, M., Vesterdal, L., Molina, J., Fischer, U., Seidling, W., Jonard, M., O'Dea, P., Johnson, J., Fischer, R., Lorenz, M. 2014. Detection of temporal trends in atmospheric deposition of inorganic nitrogen and sulphate to forests in Europe. – *Atmospheric Environment*, vol. 95 p. 363–374.

Kõlli, R., Asi, E., Szajdak, L.W., Tõnutare, T., Astover, A., Krebstein, K. 2015. Accumulation of metallic elements into the superficial peat layer of mires and wet mineral soils of Estonian forest land. – *Environmental Protection and Natural Resources*, vol. 26, issue 4, p. 6–9.

Napa, Ü., Kabral, N., Liis, S., Asi, E., Timmus, T., Frey, J. 2015. Current and historical patterns of heavy metals pollution in Estonia as reflected in natural media of different ages: ICP Vegetation, ICP Forests and ICP Integrated Monitoring data. – *Ecological Indicators*, vol. 52, p. 31–39.

Kõlli, R., Asi, E., Tõnutare, T., Astover, A., Szajdak, L., Tamm, I. 2016. Fabric and properties of mineral soils underlying a shallow peat mantle in Estonia. – *Quaternary International*, vol. 418, p. 84-93.

Nussbaumer, A., Waldner, P., Etzold, S., Gessler, A., Benham, S., Thomsen, I.M., Jørgensen, B.B., Timmermann, V., Verstraeten, A., Sioen, G., Rautio, P., Ukonmaanaho, L., Skudnik, M., Apuhtin, V., Braun, S., Wauer, A. 2016. Patterns of mast fruiting of common beech, sessile and common oak, Norway spruce and Scots pine in Central and Northern Europe. – *Forest Ecology and Management*, vol. 363, p. 237-251.

Napa, Ü., Ostonen, I., Kabral, N., Kriiska, K., Frey, J. 2017. Biogenic and contaminant heavy metal pollution in Estonian coniferous forests. – *Regional Environmental Change*, vol. 17, issue 7, p. 2111–2120.

Apuhtin, V., Asi, A. 2017. *Metsaseire*. – Eesti keskkonnaseire 2011-2015. Keskkonnaagentuur, Tallinn, lk. 69–76.

Napa, Ü. 2017. Heavy metals in Estonian coniferous forests. *Dissertationes Geographicae Universitatis Tartuensis*, 65. University of Tartu Press, 60 pp.

Ostonen, I., Truu, M., Helmisaari, H.S., Lukac, M., Borken, W., Vanguelova, E., Godbold, D.L., Lõhmus, K., Zang, U., Tedersoo, L., Preem, J.K., Rosenvald, K., Aosaar, J., Armolaitis, K., Frey, J., Kabral, N., Kukumägi, M., Leppälammi-Kujansuu, J., Lindroos, A.J., Merilä, P., Napa, Ü., Nöjd, P., Parts, K., Uri, V., Varik, M., Truu, J. 2017 Adaptive root foraging strategies along a boreal–temperate forest gradient. – *New Phytologist*, vol. 215, issue 3, p. 977–991.

van der Linde, S., Suz, L.M., Orme, C.D.L., Cox, F., Andreeae, H., Asi, E., Atkinson, B., Benham, S., Carroll, V., Cools, N., De Vos, B., Dietrich H.-P., Eichhorn, J., Gehrmann, J., Grebenc, T., Gweon, H.S., Hansen, K., Jacob, F., Kristöfel, F., Lech, P., Manninger, M., Martin, J., Meesenburg, H., Merilä, P., Nicolas, M., Pavlenda, P., Rautio, P., Schaub, M., Schröck, H.-V., Seidling, W., Šrámek, V., Thimonier, A., Thomsen, I.M., Titeux, H., Vanguelova, E., Verstraeten, A., Vesterdal, L., Waldner, P., Wijk, S., Zhang, Y., Žlindra, D., Bidartondo, M.I. 2018. Environment and host as large-scale controls of ectomycorrhizal fungi. – *Nature*, vol. 558, issue 7709, p. 243–248.

Kriiska, K., Frey J., Asi E., Kabral N., Uri V., Aosaar J., Varik M., Napa, Ü., Apuhtin V., Timmus T., Ostonen, I. 2018. Variation in annual carbon fluxes affecting the SOC pool in hemiboreal coniferous forests in Estonia. – *Forest Ecology and Management*, vol. 433, p. 419–430.

Nussbaumer, A., Waldner, P., Apuhtin, V., Aytar, F., Benham, S., Bussotti, F., Eichhorn, J., Eickenscheidt, N., Fabianek, P., Falkenried, L., Leca, S., Lindgren, M., Serrano, M.J.M., Neagu, S., Nevalainen, S., Pajtik, J., Potočić, N., Rautio, P., Gessler, A. 2018. Impact of weather cues and resource dynamics on mast occurrence in the main forest tree species in Europe. – *Forest Ecology and Management*, vol. 429, p. 336–350.

Eesti metsaseire andmeid on kasutatud veel järgmistes väljaannetess:

De Vos, B., Cools, N. 2011. Second European Forest Soil Condition Report. Volume I: Results of the BioSoil Soil Survey. INBO.R.2011.35. Research Institute for Nature and Forest, Brussel, 357 pp.

Sanders, T.G.M., Michel, A.K., Ferretti, M. 2016. 30 years of monitoring the effects of long-range transboundary air pollution on forests in Europe and beyond. UNECE/ICP Forests, Eberswalde, 67 p.

Igal aastal ilmuvalt ülevaated, milles kasutatakse Eesti metsaseire andmeid:

Forest Condition in Europe. Results of the Large-scale Survey. Technical Report of ICP Forests. United Nations Economic Commission for Europe (UNECE), Convention on Long-Range Transboundary Air Pollution (CLRTAP), International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests). Geneva, Brussels (Hamburg). (Internetis saadaval alates aastast 1999)

Forest Conditions. ICP Forests Executive Report. United Nations Economic Commission for Europe (UNECE), Convention on Long-Range Transboundary Air Pollution (CLRTAP), International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests). (Internetis saadaval alates aastast 2002)

Metsade tervislik seisund. – Aastaraamat Mets. (Autorid on olnud: V. Apuhtin, E. Asi, E. Pilt, M. Raudsaar, H. Õunap).

Igal aastal koostatakse käsikirjaline aruanne:

Apuhtin, V., Asi, E., Õunap, H., Timmus, T. Riiklik keskkonnaseire, alamprogramm 7. metsasire, aastaaruanne. Keskkonnaagentuur, Tartu. (80–90 lk.)

Üle-Euroopaliste teadusprojektide täitmiseks ja teadusartiklite koostamiseks küsitakse Eesti metsaseire ja metsamullaseire andmete kasutamise luba keskmiselt 30 korda aastas.

Päevaliblikad

Lindman, L., Remm, J., Saksing, K., Sõber, V., Õunap, E., Tammaru, T. 2014. *Lycaena dispar* on its northern distribution limit: an expansive generalist. – Insect Conservation and Diversity 8: 3-16.

Lindman, L., Remm, J., Meister, H., Tammaru, T. 2018. Host plant and habitat preference of the endangered *Euphydryas maturna* (Lepidoptera: Nymphalidae): evidence from northern Europe. – Ecological Entomology 43: 102–113.

Maes D., ja 68 autorit 2019. Integrating national Red Lists for prioritising conservation actions for European butterflies. – Journal of Insect Conservation, DOI: <https://doi.org/10.1007/s10841-019-00127-z>

Indikaatori/te kasutamine rahvusvahelises aruandluses

Van Swaay, C. ja 43 autorit. 2016. The European Butterfly Indicator for Grassland species 1990-2015. Report VS2016.19, De Vlinderstichting. Wageningen.

Van Swaay, C. ja 30 autorit. 2017. Technical report: making Bioscore distribution models based on Butterfly Monitoring Transects. De Vlinderstichting. Wageningen.

Van Swaay, C. ja 41 autorit. 2015. The European Butterfly Indicator for Grassland species 1990-2013. Report VS2015.009, De Vlinderstichting. Wageningen.

Van Swaay, C. ja 27 autorit. 2012. The European Butterfly Indicator for Grassland species 1990-2011. Report VS2012.019, De Vlinderstichting, Wageningen.

Van Swaay, C. ja 25 autorit. 2010. The European Butterfly Indicator for Grassland species 1990-2009. De Vlinderstichting, Wageningen.

Indikaatorit kasutatakse ühe üle-Euroopalise keskkonnaindikaatorina (Eurostat, Euroopa Keskkonnaamet). Lisaks kasutatakse indikaatorit ühe OECD indikaatorina.

Linnud

Elts, J. 1994. Lindude kohtamise sagedusest talilinnuloendusel. *Hirundo*, 1, 3–8.

Elts, J. 1995. Maismaa talilindude loendus Eestis aastatel 1987-1994. *Hirundo*, 1, 1–16.

Elts, J. 2001. Maismaa talilindude loendustest 1987/88-1998/99. *Hirundo*, 2, 67–84.

Elts, J. 2012. A review of 25 years of mainland winter bird counts in Estonia. *Bird Census News*, 25, 43–52.

Elts, J., Kuresoo, A., Leibak, E., Leito, A., Lilleleht, L., Luigujõe, L., Löhmus, A., Mägi, E., Ots, M. 2003. Eesti lindude staatus, pesitsusaegne ja talvine arvukus 1998.-2002.a. *Hirundo*, 16, 2, 58–63.

Elts, J., Kuresoo, A., Leibak, E., Leito, A., Leivits, A., Lilleleht, V., Luigujõe, L., Mägi, E., Nellis, Reinno, Nellis, Rein, Ots, M. 2009. Eesti lindude staatus, pesitsusaegne ja talvine arvukus 2003–2008. *Hirundo*, 22, 3–31.

Elts, J., Kuus, A., Leibak, E. 2018. Linnuatlas. Eesti haudelindude levik ja arvukus. Tartu: Eesti Ornitoloogiaühing.

Elts, J., Leito, A., Leivits, A., Luigujõe, L., Mägi, E., Nellis, Rein, Nellis, Reinno, Ots, M., Pehlak, H. 2013. Eesti lindude staatus, pesitsusaegne ja talvine arvukus 2008–2012. *Hirundo*, 26, 80–112.

Kotkanen, H., Nevalainen, T., Löhmus, A. 2004. Röövlinnud ja metsamajandus. Tallinn: Eesti Entsüklopeediakirjastus.

Kuresoo, A., Pehlak, H., Nellis, R. 2011. Population trends of common birds in Estonia in 1983-2010. *Estonian Journal of Ecology*, 60, 88–110.

Löhmus, A.; Sellis, U.; Rosenvald, R. 2005. Have recent changes in forest structure reduced the Estonian black stork *Ciconia nigra* population? *Biodiversity and Conservation*, 14, 1421–1432.

Löhmus, A. 1994. Kulliliste ja kakuliste seire tänapäev Eestis. *Hirundo*, 2, 31–45.

Löhmus, A. 1997. Kuidas uurida röövlindude sigimisedukust? *Hirundo*, 1, 33–39.

Löhmus, A. 1997. Röövlindude arvukuse muutustest Loode-Tartumaal. *Hirundo*, 1, 4–16.

Löhmus, A. 1998. Suur- ja väike-konnakotka arvukusest Eestis. *Hirundo*, 11 (1), 24–34.

Löhmus, A. 1999. Röövlinnuprojekt aastail 1994–1998. *Hirundo*, 12 (1), 19–35.

Löhmus, A. 2001. Kaitsekorralduslikult oluliste linnuliikide ohustatus ja kaitstuse kriteeriumid Eestis. *Hirundo*, Supplementum (4), 5–36.

Löhmus, A. 2001. Kui täpsed on metsakulliliste asustustiheduse hinnangud? *Hirundo*, 14, 51.

- Lõhmus, A. 2004. Röövlinnuseire 1999-2003: kanakulli kadu ja hiiretsüklite kellavärk. *Hirundo*, 17, 3–18.
- Lõhmus, A. 2011. The role of citizen science in ornithology. *Estonian Journal of Ecology*, 60, 83–87.
- Lõhmus, A., Evestus, T., Lauk, K. Väli, Ü. 1997. Röövlindude sigimisedukusest Ida- ja Kagu-Eestis. *Hirundo*, 1997, 40–50.
- Lõhmus, A., Evestus, T., Lauk, K., Väli, Ü. 1997. Röövlindude sigimisedukusest Ida- ja Kagu-Eestis. *Hirundo*, 1997, 40–50.
- Lõhmus, A., Kalamees, A., Kuus, A., Kuresoo, A., Leito, A., Leivits, A., Luigujõe, L., Ojaste, I., Volke, V. 2001. Kaitsekorralduslikult olulised linnuliigid Eesti kaitsealadel ja tähtsatel linnualadel. *Hirundo*, 37–167.
- Lõhmus, A., Kalamees, A., Kuus, A., Kuresoo, A., Leito, A., Leivits, A., Luigujõe, L., Ojaste, I., Volke, V. 2001. Kaitsekorralduslikult olulised linnuliigid Eesti kaitsealadel ja tähtsatel linnualadel. *Hirundo*, 4,
- Lõhmus, A., Kuresoo, A., Leibak, E., Leito, A., Lilleleht, V., Kose, M., Leivuts, A., Luigujõe, L., Sellis, U. 1998. Eesti lindude staatus, pesitsusaegne ja talvine arvukus. *Hirundo*, 2, 63–83.
- Lõhmus, A., Leivits, M., Pēterhofs, E., Zizas, R., Hofmanis, H., Ojaste, I., Kurlavičius, P. 2017. The Capercaillie (*Tetrao urogallus*)—An iconic focal species for knowledge-based integrative management and conservation of Baltic forests. *Biodiversity and Conservation*, 26, 1–21.
- Lõhmus, A., Nellis, R., Pullerits, M., Leivits, M. 2016. The potential for long-term sustainability in seminatural forestry: A broad perspective based on woodpecker populations. *Environmental Management*, 57, 558–571.
- Lõhmus, A., Rander, R., Rander, A. 1993. Laeva röövlinnuruut 1992. aastal. *Hirundo*, 2, 15–18.
- Lõhmus, A., Sellis, U. 2003. Nest trees – a limiting factor for the Black Stork (*Ciconia nigra*) population in Estonia. *Aves*, 40, 84–91.
- Lõhmus, A., Väli, Ü. 2001. Numbers and population dynamics of the Lesser Spotted Eagle *Aquila pomarina* in Estonia. *Acta Ornithoecologica*, 4, 291–295.
- Marja, R., Nellis, R. 2018. Perioodil 1984–2017 pöllulindude arvukuse muutus Eestis ning selle seos pöllumajanduse ja kiskjatega. *Hirundo*, 31, 49–68.
- Rosenvald, R., Lohmus, A. 2003. Nesting of the black stork (*Ciconia nigra*) and white-tailed eagle (*Haliaeetus albicilla*) in relation to forest management. *Forest Ecology and Management*, 185, 217–223.
- Stephens P.A., Mason L.R., Green R.E., Gregory R.D., Sauer J.R., Alison J., Aunins A., Brotons L., Butchart S.H.M., Campedelli T., Chodkiewicz T., Chylarecki P., Crowe O., Elts J., Escandell V., Foppen R.P.B., Heldbjerg H., Herrando S., Husby M., Jiguet F. ... Willis S.G. 2016. Consistent response of bird populations to climate change on two continents. *Science*, 352, 84–87.10.1126/science.aac4858.
- Vorišek, P., Jiguet, F., van Strien, A., Škorpilová, J., Klvanová, A., Gregory, R. D. 2010. Trends in abundance and biomass of widespread European farmland birds: How much have we lost? BOU Proceedings—Lowland Farmland Birds III. URL: <https://www.bou.org.uk/bouproc-net/lfb3/vorisek-et-al.pdf>

Väli, Ü. 2015. Monitoring of spotted eagles in Estonia, 1994–2014: Decline of the Greater (*Aquila clanga*) and stability of the Lesser Spotted Eagle (*Aquila pomarina*). *Slovak Raptor Journal*, 9, 55–64.10.1515/srj-2015-0004.

Väli, Ü. 2017. The recent decades of Montagu's Harrier *Circus pygargus* in Estonia: numbers, reproductive success and habitats. *Vogelwelt*, 137, 351–358.

Väli, Ü. 2018. Talvitavate röövlindude arvukuse seire Eestis 2014–2018. aastal. *Hirundo*: 31, 25–38.

Väli, Ü. 1997. Röövlinnud Lõuna-Hiiumaal. *Hirundo*, 1997, 26–27.

Väli, Ü., Elts, J., Pehlak, H. 2018. Are common bird monitoring schemes and casual observations appropriate for estimating raptor trends? *Bird Study*, <https://doi.org/10.1080/00063657.2018.1506422>.

Väli, Ü., Löhmus, A. (1998). Suur-konnakotkas. *Hirundo*, 2, 105.

Väli, Ü.; Laansalu, A. 2002. Röövlindude arvukus, sigimisedukus ja toitumine Härjanurme vaatlusuudus Tartumaal 1992.-2001. a. *Hirundo*, 15, 35–46.

Indikaatori/te kasutamine rahvusvahelises aruandluses

Indikaatorit kasutatakse ühe üle-Euroopalise keskkonnaindikaatorina (Eurostat, Euroopa Keskkonnaamet). Lisaks kasutatakse metsa- ja põllulindude indikaatoreid OECD Indikaatorite na.

Ulukid

Tõnisson, J.; Randveer, T. 2003. Monitoring of moose-forest interactions in Estonia as a tool for game management decisions. *Alces*, 39, 255–262.

Männil, P. 2004. Hinnang hundi, ilvese ja karu populatsioonide seisundile Eestis aastal 2003. Hiiumaa 2003. aasta sügiskooli materjale. *Eesti Ulukid No 9*: 13-22.

Männil, P. 2006. Large Carnivores and LC management strategy in Estonia. Transboundary management of large carnivore populations. *Environmental encounters*, No 60. Council of Europe. 49-51.

Männil, P. & Kübarsepp, M. 2006. Muutused hundi, ilvese ja karu Eesti asurkondade seisundis aastatel 2002-2006. *Eesti Looduseuurijate Seltsi aastaraamat*. 84. Köide. *Eesti Looduseuurijate Selts*, lk 227-253.

Sarma, U., Ho, S.Y.W., Pybus, O.G., Kaljuste, M., Tumanov, I.L., Kojola, I., Vorobiev, A.A., Markov, N.I., Saveljev, A.P., Valdmann, H., Lyapunova, E.A., Abramov, A.V., Männil, P., Korsten, M., Vulla, E., Pazetnov, S.V., Pazetnov, V.S., Putchkovskiy, S.V., Rõkov, A.M. 2007. Mitogenetic structure of brown bears (*Ursus arctos* L.) in north-eastern Europe and a new time-frame for the formation of European brown bear lineages. *Molecular Ecology*, 16: 401-413

Veeroja, R.; Tõnisson, J.; Tilgar, V. 2007. Effects of hunting, wolf-predation and winter climate on population dynamics of moose (*Alces alces*) in Estonia. Dynamics of game animals populations in northern Europe. Proceedings of the IVth International Symposium. Petrozavodsk, Russia, 2007,

212pp. Ed. Danilov, P. Petrozavodsk, Russia: Karelian Research Centre, Russian Academy of Sciences, 178–182.

Männil, P.; Randveer, T. (2007). Dynamics of Estonian big game populations: reasons and consequences. Dynamics of game animals populations in Northern Europe: Dynamics of game animals populations in Northern Europe. IV International Symposium. Petrozavodsk, Russia. September 18 - 22, 2006. Ed. P. Danilov. 125–128.

Veeroja, R.; Tilgar, V.; Kirk, A.; Tõnisson, J. 2008. Climatic effects on life-history traits of moose in Estonia. *Oecologia*, 154 (4), 703–713.

Schmidt, K., Kowalczyk, R., Ozolins, J., Männil, P., Fickel, J. 2009. Genetic structure of the Eurasian lynx population in north-eastern Poland and the Baltic states. *Conserv Genet* 10: 497-501

Korsten M, Ho SYW, Davison J, Pähn B, Vulla E, Roht M, Tumanov IL, Kojola I, Andersone-Lilley Z, Ozolins J, Pilot M, Mertzanis Y, Giannakopoulos A, Vorobiev AA, Markov NI, Saveljev AP, Lyapunova EA, Abramov AV, Männil P, Valdmann H, Pazetnov SV, Pazetnov VS, Rökov A and Saarma U. (2009) Sudden expansion of a single brown bear lineage in northern continental Eurasia: a general model for mammals after the last ice age? *Molecular Ecology*, 18: 1963-1979

Andersone-Lilley, Z.; Balčiauskas, L.; Ozolinš, J.; Randveer, T.; Tõnisson, J. 2010. Ungulates and their management in the Baltics (Estonia, Latvia and Lithuania). In: M. Apollonio, R. Andersen, R. Putman (Ed.). European Ungulates and their Management in the 21 century (103–128).. Cambridge University Press.

Tammeleht E, Remm J, Korsten M, Davidson J, Tumanov I, Saveljev A, Männil P, Kojola I, Saarma U. (2010). Genetic structure in large, continuous mammal populations: the example of brown bears in northwestern Eurasia. *Molecular Ecology*, 19: 5359-5370

Veeroja, R., Kirk, A., Tilgar, V., Säde, S., Kreitsberg, M., Tõnisson, J. 2010. Conception date affects litter type and foetal sex ratio in female moose in Estonia. *Journal of Animal Ecology*, 169–175.

Jõgisalu, I., Männil, P., Kont, R. 2010. Spreading of sarcoptic mange in Estonian wolf population following anti-rabies vaccination programme. *Vestnik ohotovedenija*, Vol 7, N° 2: 372-375.

Jedrzejewski, W., Jedrzejewska, B., Anderzone-Lilley, Z., Balčiauskas, L., Männil, P., Ozolins, J., Sidorovich, V.E., Bagrade, G., Kübarsepp, M., Ornicans, A., Nowak, S., Pupila, A. & Žunna, A. 2010. Synthesizing Wolf Ecology and Management in Eastern Europe: Similarities and Contrasts with North America. In: Musiani, M., Boitani, L. & Paquet, P.C.(ed.) 2010. *The World of Wolves: New Perspectives on Ecology, Behaviour and Management*. University of Calgary Press, 207-233.

Ratkiewicz, M., Matosiuk, M., Kowalczyk, R., Konopiński, M. K., Okarma, H., Ozolins, J., Männil, P., Ornicans, A. & Schmidt, K. 2012. High levels of population differentiation in Eurasian lynx at the edge of the species' western range in Europe revealed by mitochondrial DNA analyses. *Animal Conservation*, 15: 603-612

Bishof, R., Nielsen, E., Brøseth, H., Männil, P., Ozolinš, J. & Linnell, J. 2012. Implementing uncertainty when using recreational hunting to manage large carnivores. *Journal of Applied Ecology*, 49: 824-832

Hindrikson, M., Männil, P., Ozolins, J., Krzywinski, A. & Saarma, U. 2012. Bucking the Trend in Wolf-Dog Hybridization: First Evidence from Europe of Hybridization between Female Dogs and Male Wolves. *PLOS ONE* 7(10): e46465. doi:10.1371/journal.pone.0046465

Keis, M., Remm, J., Ho, S. Y. W., Davison, J., Tammeleht, E., Tumanov, I. L., Saveljev, A. P., Männil, P., Kojola, I., Abramov, A. V., Margus, T., Saarma, U. 2013. Complete mitochondrial genomes and a novel spatial genetic method reveal cryptic phylogeographical structure and migration patterns among brown bears in north-western Eurasia. *Journal of Biogeography*, 40: 915-927

Hindrikson, M., Remm, J., Männil, P., Ozolins, J., Tammeleht, E., Saarma, U. 2013. Spatial Genetic Analyses Reveal Cryptic Population Structure and Migration Patterns in a Continuously Harvested Grey Wolf (*Canis lupus*) Population in North-Eastern Europe. *PLoS ONE* 8(9): e75765. doi:10.1371/journal.pone.0075765

Veeroja, R.; Kirk, A.; Tilgar, V.; Tönnisson, J. 2013. Winter climate, age and population density affect the timing of conception in female moose (*Alces alces*). *Acta Theriologica*, 58 (4), 349–357.10.1007/s13364-012-0106-9.

Veeroja, R., Männil, P., 2014. Population development and reproduction of wild boar (*Sus scrofa*) in Estonia. *Wildlife Biology in Practice*, 10 (3), 17–21.10.2461/wbp.2014.un.3.

Chapron, G., Kaczenski, P., Linnell, J. D. C., von Arx, M., Huber, D., Andrén, H., López-Bao, J. V., Adamee, M., Álvares, F., Anders, O., Balčiauskas, L., Balys, V., Bedő, P., Bego, F., Blanco, J. C., Breitenmoser, U., Brøseth, H., Bufka, L., Bunikyte, R., Ciucci, P., Dutsov, A., Engleeder, T., Fuxjäger, C., Groff, C., Holmala, K., Hoxha, B., Iliopoulos, Y., Ionescu, O., Jeremić, J., Jerina, K., Kluth, G., Knauer, F., Kojola, I., Kos, I., Krofel, M., Kubala, J., Kunovac, S., Kusak, J., Kutil, M., Liberg, O., Majić, A., Männil, P., Manz, R., Marboutin, E., Marucco, F., Melovski, D., Mersini, K., Mertzanis, Y., Myslajek, R., Nowak, S., Odden, J., Ozolins, J., Palermo, G., Paunović, M., Persson, J., Potočnik, H., Quenette, P-Y., Rauer, G., Reinhardt, I., Rigg, R., Ryser, A., Salvatori, V., Skrbinešek, T., Stojanov, A., Swenson, J. E., Szemethy, L., Trajce, A., Tsingarska-Sedefcheva, E., Váňa, M., Veeroja, R., Wabakken, P., Wölfl, M., Wölfl, S., Zimmerman, F., Zlatanova, D., Boitani, L. 2014. Recovery of large carnivores in Europe's modern human-dominated landscapes. *Science* Vol. 346 no. 6216: 1517-1519 DOI: 10.1126/science.1257533

Niedziałkowska, M., Hundertmark, K. J., Jezdrzejewska, B., Niedziałkowski, K.; Sidorovich, V.E., Gorny, M., Veeroja, R., Solberg, E.J., Laaksonen, S., Sand, H., Solovyev, V.A., Shkvyrka, M., Tiainen, J., Okhlopkov, I.M., Juskaitis, R., Done, G., Borodulin, V.A., Tulandin, E.A., Jezdrzejewski, W. 2014. Spatial structure in European moose (*Alces alces*): genetic data reveal a complex population history. *Journal of Biogeography*, 41 (11), 2173–2184.10.1111/jbi.12362.

Ratkiewicz, M., Matosiuk, M., Saveljev, A. P., Sidorovich, V., Ozolins, J., Männil, P., Balčiauskas, L., Kojola, I., Okarma, H., Kowalczyc, R., Schmidt, K. 2014. Long-Range Gene Flow and the Effects of Climatic and Ecological Factors on Genetic Structuring in a Large, Solitary Carnivore: The Eurasian Lynx. *PLoS ONE* 9(12): e115160. doi:10.1371/journal.pone.0115160

Ozolinš, J., Männil, P., Balčiauskas, L., Ornicans, A. 2014. Ecological, social and economic justification of wolf population management in the Baltic region. *Beiträge zur Jagd- und Wildforschung*, Bd. 39: 215-224

Oja, R., Kaasik, A., Valdmann, H. 2014. Winter severity or supplementary feeding—which matters more for wild boar? *Acta Theriologica*, 59 (4), 553–559. link.springer.com/article/10.1007/s13364-014-0190-0.

Rutkowski R, Krofel M, Giannatos G, Ćirović D, Männil P, Volokh AM, Lanszki J, Heltai, M, Szabó L, Banea OC, Yavruyan E, Hayrapetyan V, Kopaliani N, Miliou A, Tryfonopoulos GA, Lymberakis P, Penezić A, Pakeltytė G, Suchcka E, Bogdanowicz W. 2015. A European Concern? Genetic Structure

and Expansion of Golden Jackals (*Canis aureus*) in Europe and the Caucasus. PLoS ONE 10(11): e0141236. doi:10.1371/journal.pone.0141236

Niedziałkowska, N., Hundertmark, K.J., Jędrzejewska, B., Sidorovich, V.E., Zalewska, H., Veeroja, R., Solberg, E.J., Laaksonen, S., Sand, H., Solovyev, V.A., Sagaydak, A., Taininen, J., Juškaitis, R., Done, G., Borodulin, V.A., Tulandin, E.A., Niedziałkowski, K. 2016. The contemporary genetic pattern of European moose is shaped by postglacial recolonization, bottlenecks, and the geographical barrier of the Baltic Sea. Biological Journal of the Linnean Society, 117, 4, 879–894.

Plumer L, Keis M, Remm J, Hindrikson M, Jõgisalu I, Männil P, Kübarsepp M, Saarma U. 2016. Wolves recolonizing islands: genetic consequences and implications for conservation and management. PLoS ONE. 2016; 11(7): e0158911. doi:10.1371/journal.pone.0158911

Plumer L, Talvi T, Männil P, Saarma U. 2018. Assessing the roles of wolves and dogs in livestock predation with suggestions for mitigating human-wildlife conflict and conservation of wolves. Conservation Genetics (2018) 19:665-672, <https://doi.org/10.1007/s10592-017-1045-4>

Männil, P., Mustasaar, M. 2018. Jackal's expansion towards north: Can they survive in boreal ecosystem? In Ginnatos G., Banea O.C., Hatlauf J., Sillero-Zubiri C., Georgiadis C., and A. Legakis (Eds.) (2008) Proceedings of the 2nd International Jackal Symposium, Marathon Bay, Attici Greece 2018. Hell. Zool. Arch., No 9 Nov 2018, ISSN: 1106-2134 (pp: 110-111)

Raportid:

Linnell, J.D.C., Skogen, K., Andersone-Lilley, Z., Balciauskas, L., Herfindal, I., Kowalczyk, R., Jedrzejewski, W., Mannil, P., Okarma, H., Olszanska, A., Ornicans, A., Ozolins, J., Poltimäe, R., Randveer, T., Schmidt, K. & Valdmann, H. (2006). Large carnivores in northern landscapes: Final report. Status survey, conflicts, human dimensions, ecology and conservation of bears, lynx and wolves in Estonia, Latvia, Lithuania and Poland. 116pp. NINA, Trondheim, Norway.

Kaczensky, P, Chapron G, von Arx M, Huber D, Andrén H, Linnell J (eds), 2013. Status, Management and Distribution of Large Carnivores—Bear, Lynx, Wolf and Wolverine—in Europe. Report to the EU Commission, Part 1 and Part 2:

http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_1_part1_statusoflcineurope.pdf and

http://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_1_part2_species_country_reports.pdf.

Boitani, L., F. Alvarez, O. Anders, H. Andren, E. Avanzinelli, V. Balys, J. C. Blanco, U. Breitenmoser, G. Chapron, P. Ciucci, A. Dutsov, C. Groff, D. Huber, O. Ionescu, F. Knauer, I. Kojola, J. Kubala, M. Kutil, J. Linnell, A. Majic, P. Mannil, R. Manz, F. Marucco, D. Melovski, A. Molinari, H. Norberg, S. Nowak, J. Ozolins, S. Palazon, H. Potocnik, P.-Y. Quenette, I. Reinhardt, R. Rigg, N. Selva, A. Sergiel, M. Shkvyrina, J. Swenson, A. Trajce, M. Von Arx, M. Wolfl, U. Wotschikowsky, D. Zlatanova, 2015. Key actions for Large Carnivore populations in Europe. Institute of Applied Ecology (Rome, Italy). Report to DG Environment, European Commission, Bruxelles. Contract no. 07.0307/2013/654446/SER/B3

EFSA (European Food Safety Authority), Boklund A, Cay B, Depner K, F€oldi Z,

Guberti V, Masiulis M, Miteva A, More S, Olsevskis E, _Satr_an P, Spiridon M, Stahl K, Thulke H-H, Viltrop A, Wozniakowski G, Broglia A, Cortinas Abrahantes J, Dhollander S, Gogin A, Verdonck F, Amato L, Papanikolaou A and Gort_azar C, 2018. Scientific report on the epidemiological analyses of African swine fever in the European Union (November 2017 until November 2018). EFSA Journal 2018;16(11):5494, 106 pp. <https://doi.org/10.2903/j.efsa.2018.5494>

Linnell, J. D. C. & Cretois, B. 2018. Research for AGRI Committee – The revival of wolves and other large predators and its impact on farmers and their livelihood in rural regions of Europe, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels

Indikaatori/te kasutamine rahvusvahelises aruandluses:

Alates 2009. aastast kord aastas avaldatav aruanne „Ulukiasurkondade seisund ja küttimissoovitus“. Keskkonnaagentuuri kohustus vastava aruande koostamiseks tuleneb EV Jahiseadusest ja keskkonnaministri määrusest „Jahiulukite seireandmete loetelu ja kogumise kord ning seiret korraldama volitatud asutus“

EL loodusdirektiivi aruandlus – jahiulukitest pruunkaru, hunt, ilves, valgejänes, kobras, metsnugis, tuhkur.

Jahiulukite peatükid sarjas „Aastaraamat Mets“ (Keskkonnaagentuur ja selle eelkäiad).

Metsaelupaigatübid

Palo, A. 2012. Loodusdirektiivi metsaelupaikade seisund Eestis. Käsikiri. Tellija Keskkonnaministeerium. 77 lk.

Palo, A., Gimbutas, M. 2013. Dynamics of tree layer composition, tree age and large diameter trees in Habitats Directive Annex I forest habitats in Estonia on the basis of monitoring data collected from 2010–2012. *Metsanduslikud Uurimused/Forestry studies* 58: 57–73.

Palo, A., Gimbutas, M. 2014. 20. sajandi maakasutuse muutused ja tänaste loodusdirektiivi metsaelupaikade kujunemine. Tammiksaar, E.; Pae, T.; Mander, Ü. (Toim.). *PUBLICATIONES INSTITUTI GEOGRAPHICI UNIVERSITATIS TARTUENSIS* 111. Tartu: Eesti Ülikoolide Kirjastus. Lk 204 – 218.

Palo, A., Gimbutas, M. 2015. Habitat Directive forest type Western taiga (*9010) in Estonia – the first description of stand structure according to mapping and monitoring data. *Baltic Forestry* 21, 16 – 27.