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MAIA
Mapping and Assessment for Integrated ecosystem Accounting

The MAIA country fact sheets summarize the state of affairs on natural capital accounting (NCA) in the countries connected to the MAIA project. They serve as an accessible overview and entry point for collaboration. The factsheets describe the needs from policy, society, science and business for the use of NCA, give an overview of the ongoing and published research -including knowledge gaps- in the country, include contact details and an overview of national partners and stakeholders involved in the accounts. Information in this document is based on MAIA Deliverables and exchanges, and the content is reviewed, co-authored and updated by MAIA-liaison persons in the participating country. This version was updated on August 5th 2022

Country fact sheet:

Greece (EL)

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Summary

Ecosystem accounting in Greece is currently in its infancy. However, the policy relevance is clear. The development of environmental accounts will help the government, public administrative institutions, NGOs and the private sector in making informed decisions. Furthermore, it will favor system thinking. When publicly accessible, these accounts are hoped to empower the informed, aware citizen in the chain of decision making.

Up to now, no accounts have been finalized yet in Greece. However, a national ecosystem extent account, an ecosystem monetary asset account and a thematic biodiversity account, all for woodland and forest, are under development and expected to be published soon. Regarding accounts for ES, a methodological framework is being designed for physical as well as for monetary accounting of water-related ecosystem services (i.e. water regulation).

The data needed for setting up natural capital accounting in Greece is scarce and unavailable. Methodologies have been worked out to gather missing information and start the development of accounts on ecosystems, ecosystem services and biodiversity.

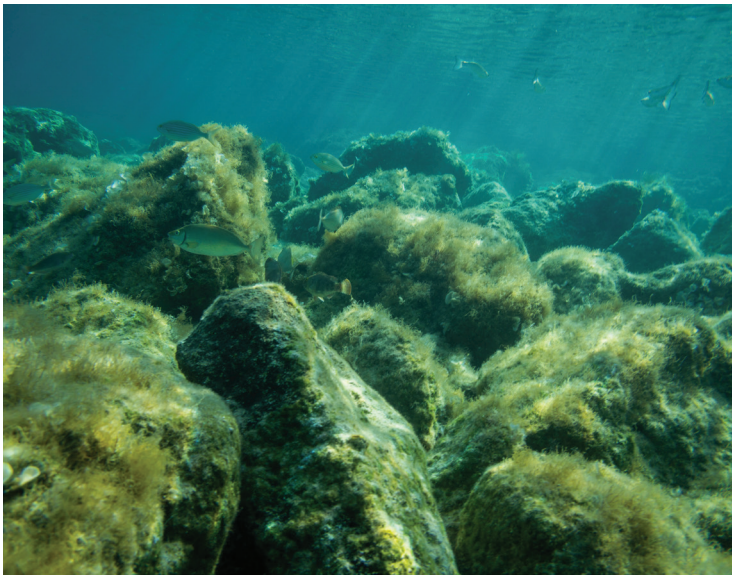
The main obstacles for the SEEA EEA implementation in Greece are the available capacity and expertise of the involved stakeholders and state agencies, along with data gaps. Knowledge sharing among MAIA partners is hoped to address these shortcomings and provide guidance via each country's pilot accounts.

Country policy priorities for developing natural capital accounts

Based on MAIA D5.1 (Annex 7 section 3)

Ecosystem accounting in Greece is currently in its infancy. However, the policy relevance is clear. The development of environmental accounts will help the government, public administrative institutions, NGOs and the private sector in making informed decisions. Furthermore, it will favor system thinking. When publicly accessible, these accounts are hoped to empower the informed, aware citizen in the chain of decision making.

The development of environmental accounts will help establish a common database that government, public administrative institutions, NGOs and the private sector can employ for informed decisions, management and action plans drafting and implementation, aiming at no loss or net gain of ecosystem condition and ecosystem services. Furthermore, it will favor system thinking, evaluating and highlighting all aspects of an issue, instead of focusing only on e.g. one or two parameters. Publicly accessible, these accounts can be a valuable tool to scrutinize any actions, weigh pros and cons, thus enhancing the role of the informed, aware citizen in the chain of decision making.



Pilot accounts under development

Summary table of accounts

Account		Ecosystem Types / Ecosystem Services	Link to research
Accounts for ecosystem assets	Ecosystem extent account	**All ecosystems***	
	Ecosystem condition account	**All ecosystems inside Natura 2000 SCIs**	
	Ecosystem monetary asset account	*Forest and woodland*	
Accounts for ecosystem services	Ecosystem services supply and use table - physical terms	**Water regulation***	
	Ecosystem services supply and use table - monetary terms	**Water regulation***	
Thematic accounts	Reference values	**Biodiversity***	Kotsiras et al. 2020; Cheminal et al. 2022

Scale	State of development
National	Finished
Regional	Ongoing
Local	None ongoing or published
*Highlighted in the fact sheet	

Summary overview of highlight accounting projects

Ecosystem Extent Accounts

Ecosystem extent accounting tables and mapping have been compiled, focusing on the region of Peloponnese; however, extent accounts are being prepared for the entire country. The accounts include:

- Extent in physical terms for each ecosystem type
- Changes in the extent of each ecosystem type, throughout the years

Water accounts

According to the EU's Water Framework Directive (WFD) reporting obligations, Greece has completed two River Basin Management Plans (RBMP) updates, providing a wealth of spatial and temporal datasets for water resources. In our work, the SEEA-EEA framework has been applied on freshwater resources, i.e. surface- (river and lakes) and ground-water bodies at river basin scale in Greece, in terms of: (a) extent accounts, (b) condition accounts, (c) supply and use of provisioning ecosystem services, focusing on drinking and irrigation water supply and use accounts (the prevailing water uses in the examined river basin) for selected years from 2010 to 2021, depending on the availability of adequate and reliable data. The case study for applying the water ecosystem accounts is the Alfeios river basin (RB) in the Water District of Western Peloponnese, Greece. More precisely, this river basin scale has been selected, since the biggest river basin of this region with a drainage area of 3660 km2 and a 112 km watercourse (Bekri and Yannopoulos, 2012). Alfeios is situated in the Western and Central Peloponnese, passing through Ancient Olympia just before its estuaries to Kyparissiakos Gulf. It is considered as the most significant ecosystem and natural resources system of this region.

Extending the mapping and assessment of ecosystems and their services at local scale, we also valued water ESs in order to enable their integration into pilot accounts. Ecosystem indicators in biophysical and monetary terms in accordance with the ecosystem accounting framework are used to estimate and map the supply and use capacity, thus the flows of water ESs. Existing datasets from the official RBMPs and other relative available datasets reported in EU are analyzed, properly transformed, and used for this purpose. More precisely, we used datasets from the two reporting WFD cycles, Corine LU/LC, Population census, Eurostat Water database, IACS geodatabase, JRC Global Surface Water, FADN standard output, Hellenic Statistical Authority. The water accounts have been expressed in spatial units, using the EEA reference grid for Greece with cell size 1×1 km2. The spatial analysis for the mapping and the assessment of the freshwater ecosystems and their services was undertaken in ArcMap 10.8. Based on this analysis, surface and groundwater bodies do not show any significant change as concerns extent.

Water extent and condition accounts

Freshwater (surface and groundwater) extent accounts at MAES level 3, identifying rivers, lakes and groundwater bodies have been conducted: (i) from 1990 to 2018 using Corine LU/LC for rivers and lakes, (ii) between 1984 and 2020 identifying changes in lakes seasonality using JRC Global Surface Water and (iii) from 2010 to 2021 for rivers, lakes and groundwaters extent based on the two WFD reporting cycles of RBMPs. Water condition accounts have been conducted based on the freshwater condition, i.e (i) ecological condition reported for river and lake water bodies and (ii) chemical, quantitative & total condition for groundwater bodies, with opening period (2009-2015) and closing period (2016-2021), utilizing the two WFD reporting cycles of RBMPs. Based on this analysis, a barely noticeable overall negative trend is observed in the river ecological condition and no change to groundwater condition.

Surface and groundwater potential

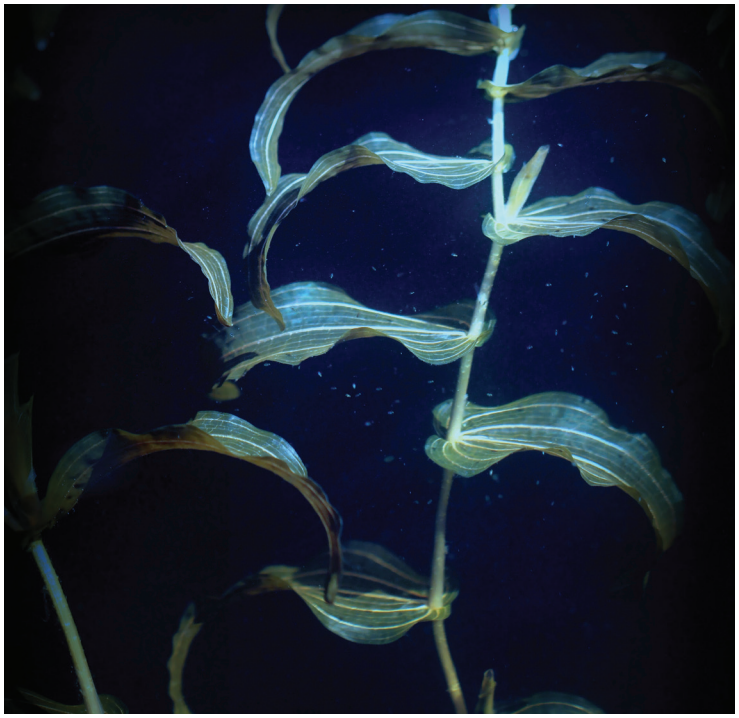
Based on the two WFD reporting cycles of the RBMPs, freshwater potential datasets, including mean annual physical flow and abstraction and the various water uses have been collected and properly analyzed at water body scale. Using ArcMap 10.8, surface and groundwater long-term potential tables and maps, have been conducted at water body scale, using the mean annual physical water flow values (or groundwater recharge or lake water volume) of each water body.

Water Supply and Use Accounts

Methodological framework for water resources valuation in RBMPs: In 2017 the National Water Committee of Greece set forward rules for the cost assessment and the pricing of water services (Joint Ministerial Decision 135275/2017). These rules constitute the framework within which River Basin Management Plans work their economic evaluation for the second revision. The cost assessment of water services evaluates three distinct cost elements, according to a Water Framework Directive guidance: (a) the financial cost, (b) the environmental cost, and (c) the resource cost. This assessment supports the estimation of the unit cost, the cost-recovery and the decision related to the optimum pricing of the resource. In a broader context, cost assessment and pricing provide inputs for the calculation of the cost-efficiency of various alternative measures in a cost-benefit framework. Based on the approved River Basin Management Plans of Greece. For the Alfeios River Basin, which is one of the river basins composing the River Basin District of Western Peloponnese and is chosen as the pilot case study (Peloponnese), the above-mentioned costs are given in the following table.

Drinking water ES

Drinking water supply and use maps in biophysical and monetary terms, as well as summary accounting tables at river basin and at cell scale, from 1991 to 2021 (based on the population census data of permanent and non-permanent residents), have been completed, providing useful conclusions for the regions of low and high supply and use of drinking water ES. For the drinking water valuation, we used the methodological analysis proposed in the RBMPs as analysed above. From the various ecosystem indicators, in our work, we used the unit financial cost in € per m3 of supplied water as the most appropriate, since there is no competitive market. In the Alfeios River basin, the annual drinking water use and supply in 2021 is circa 9.5 and 13 million m3 and their total value 6 and 8 million Euros, respectively, and in summer period 3.5 and 5 million m3 and their total value 2 and 3 million Euros, respectively.



Irrigation water ES

Annual irrigation water supply and use maps have been conducted in biophysical and monetary terms, as well as summary accounting tables at river basin level from 2015 to 2018. The residual valuation method utilised the agricultural area from IACS, the standard output per cultivation from FADN database and regional agricultural accounts coefficients. The use value for irrigation water in 2018 is close to 29 million. The total annual water use and supply in Alfeios RB is circa 64 and 87 million m3 in 2018, whereas a 7% decrease of the total irrigated area is observed between 2015 and 2018 and a decreasing trend of 8% for annual water use and 5% for annual water supply.

Annual drinking water use change between 2015 and 2021: With red the regions of positive high drinking water use change are depicted; with orange the regions of positive medium drinking water use change; with yellow the regions with positive low drinking water use change; with grey the regions with no change; and with light green the regions of negative low drinking water use change between 2015 and 2021.

	Total financial cost (€)	Unit financial cost (€/m³)	Total mean income (€)	Average Unit income (€/m³)
Potable water	5,960,353	0.626	4,567,992	0.480
Irrigation water	5,039,835	0.14	3,010,409	0.084
	Annual environmental cost (€)	Unit environmental cost (€/m³)	Annual recovery cost (€)	Mean Unit recovery cost (€/m³)
Alfeios water system	75,000	0.0006	0	0

Biodiversity account

Biophysical

Focusing both on flora and fauna, these accounts will inform the user on:

- **Species richness;**
- **Endemism (including exclusive per ecosystem type endemism);**
- **Changes in habitat types;**
- **Aromatic and medicinal plants diversity and ecosystem services;**
- **Number of protected taxa;**
- **Number of alien plants.**

An extensive database for vascular plants is available for Greece, and already a relevant pilot study is published, regarding floristic diversity indices (i.e. ecosystem asset proxy indicators) for woodland and forest ecosystems, framing the methodological approach (Kotsiras et al. 2020) (Figure 1). Relevant time series are developed, including floristic diversity indices for all natural ecosystem types, integrating their area as a weight factor. The case of the total species richness indicator, for the region of Peloponnese, is presented in Figure 2.

Available information on fauna is covering specific taxonomic groups, such as butterflies, birds and amphibians, as well as, ranges of roaming for bigger mammals (fauna related accounts are ongoing).

By establishing an assessing methodology, we will be able to monitor the environmental importance of a spatial unit (10kmx10km grid cells are proposed). Each spatial unit will be assigned to a score according to a national or regional indicator, depending on the scale of the study. The comparison of the spatial units themselves is going to indicate areas of interest, like hotspots of biodiversity, and, in tandem with time series, will calculate and inform on significant changes, assessing ultimately the efficiency of established policies or the lack of them.

Monetary

Valuation of forest biodiversity is conducted by implementing the methodology adopted by the Greek State (Albanis et al. 2015; Ciancio et al. 2007) which is based on the area size of each ecosystem type and as follows:

Vb = Area * N *Pb,

Vb = biodiversity value (euro)

Area = area in ha

N = naturalness coefficient (see Albanis et al. 2015, page 111)

Pb = forest biodiversity value (euro/ha per year) (see Albanis et al. 2015, page 113-113)

By applying this methodology on forest ecosystems extent change, biodiversity valuation is also calculated, for each reference year, respectively.

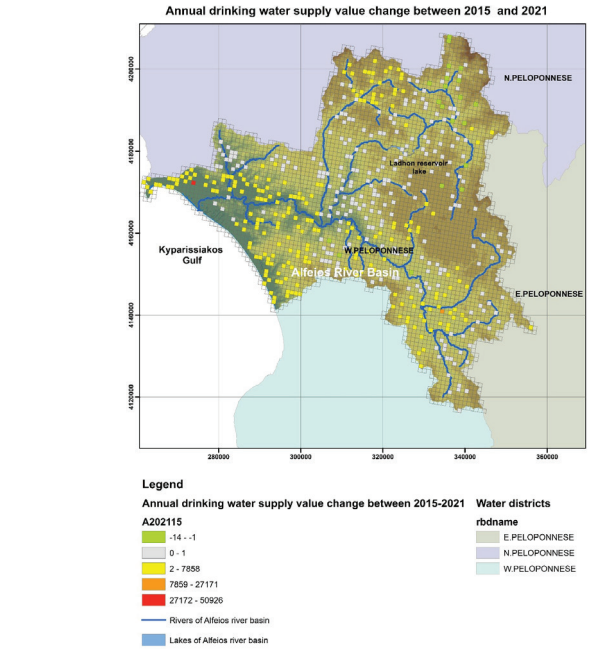


Figure 1

Thematic representation of the four ecosystem asset proxy indicators: (a) Total plant species index; (b) total plant species exclusively present in woodland and forest index; (c) endemic species index; (d) endemic species exclusively present in woodland and forest index. Floristic regions of Greece are also depicted: East Aegean islands (EAe), East Central Greece (EC), Ionian Islands (Iol), Kriti and Karpathos (KK), Kiklades (KiK), North Aegean islands (NAe), North Pindos (NPi), North Central Greece (NC), North-East Greece (NE), Peloponnisos (Pe), South Pindos (SPi), Sterea Ellas (StE), West Aegean islands, (WAe). (Source: Kotsiras et al. 2020).

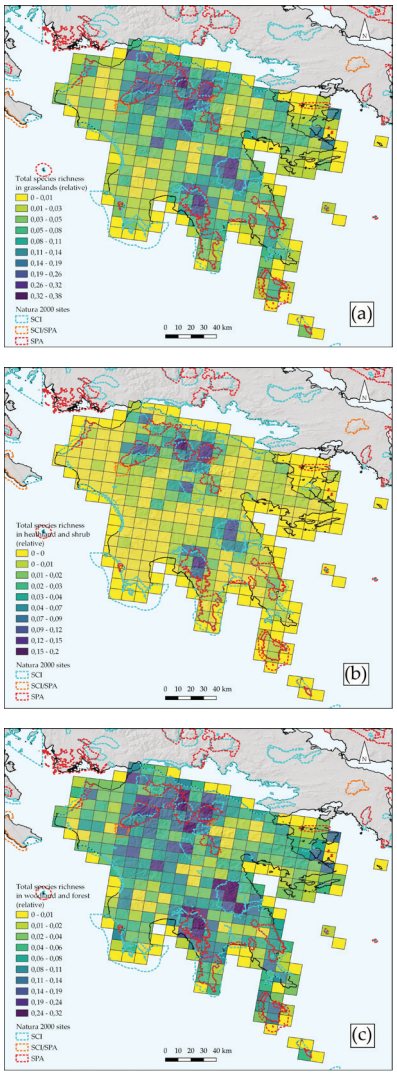


Figure 2

Total species richness indicator, for (a) grasslands, (b) heathland and shrub and (c) woodland and forest, weighted using total species richness of each ecosystem type in the floristic region of Peloponnese.

Knowledge gaps and difficulties for developing natural capital accounts

Based on MAIA D3.2 (Annex 7 section 3.1, 3.2 and 3.5)

The data needed for setting up natural capital accounting in Greece is scarce and unavailable. Methodologies have been worked out to gather missing information and start the development of accounts on ecosystems, ecosystem services and biodiversity, focusing on setting the baseline, reference values.

Data is available in respective agencies, but mainly only for their internal use and time series are scarce. Efforts are ongoing to acquire and develop more concrete databases. Therefore, data gaps have been addressed addressed through stakeholder engagement. This will be made possible by national workshops and personal contacts. MAIA efforts and outcomes supported national efforts for the development of a an appropriate methodological approach for NCA, based on available datasets and capacity.

Greece produces environmental accounts in terms of flows for e.g., raw material, water and energy. However, Greece does not produce NCA and the first involvement of Greece for NCA, based on the SEEA Ecosystem Accounting approach, starts with the participation in the MAIA project. Only a few studies try to assess ecosystems, most of them under the perspective of the potential for the supply of recreational ecosystem services or by assessing one major resource (e.g. drinking and irrigation water supply). More data is available for forest productivity and their outputs, but this is also limited to the areas where timber production occurs. Adequate data for ecosystem accounting is available for agricultural ecosystems, but only for the monetary value of their products. Accounting for biodiversity and other regulating and maintenance services, as well as their cultural value (especially at traditional cultivated land) are unknown. One useful valuation approach for woodland and forest ecosystem type in Greece is the "Methodology for estimating the value of forest land in Greece" (Almpanis et al. 2015). The proposed methodology for forest area valuation is (a) used for forest ecosystems accounting in Peloponnese and (b) the basis for developing valuation models for all types of terrestrial ecosystems as well as for their attributes (e.g. biodiversity, water quality and quantity).

Biodiversity accounting is based on the information provided by (a) the Flora of Greece Web project, (b) fauna databases available for the Peloponnese, (c) habitats Directive database, (d) water framework directive dataset, (e) soil data and (f) climatic data. The above-mentioned data will be combined to initially assess the condition of biodiversity (at all levels from ecosystem type- to species- level) and thus provide a concrete indicator to be used for the accounting. This approach supports a biodiversity-based accounting, following the EU MAES framework, which places biodiversity at the epicenter of the natural environment attributes. Subsequently, a typology has been created and proposed linking biodiversity attributes to ecosystems (at MAES level 3) (Kokkoris et al. 2020). Cumulative accounting will be based on the aforementioned MAES ecosystem types' classification (Maes et al. 2013).

Support needs for developing natural capital accounts

Based on MAIA D3.2 (Annex 7 section 3.3)

The main obstacles for the SEEA EEA implementation in Greece are the available capacity and expertise of the involved stakeholders and state agencies, along with data gaps. Knowledge sharing among MAIA partners helped to many of these shortcomings and provide guidance via each country's pilot accounts.

The main gaps are identified on valuation methods and modeling techniques. This ongoing process should include data and relevant information from other related projects, including different scientific fields which can provide input via their outcomes (e.g. time series on some specific biophysical attributes or conditions for selected taxonomic groups).

MAIA contribution is already evident, triggering the national LIFE-IP 4 NATURA project (coordinated by the Ministry of Environment and Energy) to include natural capital accounting as one of its Actions, collecting feedback and exploit knowledge transfer from the MAIA case-studies and outcomes. Moreover, the participation of the University of Patras MAIA Team in NCA efforts, has been acknowledged since the Hellenic Statistical Authority requested support on exchanging information and outcomes towards NCA reporting (even if this is at a premature stage).

Involved partners and stakeholders

Based on D5.1 (Annex 7 section 2);
European NCA stakeholder day

Government	Research	Private sector or NGO
Decentralized administration of Peloponnese Western Greece and the Ionian: • Directorate of Forest coordination and supervision • Directorate of Agricultural Affairs • Directorate of civil protection • Directorate of Environment and land Planning • Water Directorate	University of Patras (UPAT) • Department of Biology • Department of Economics	WWF
Natural Environment & Climate Change Agency		Hellenic Ornithological Society
Ministry of Environment and Energy		
Hellenic Statistical Authority		

References

Almpanis, K., Xanthopoulos, G., Skouteri, A., Theodoridis, N., Christodoulou, A., Palaskas, D., 2015. Methodology for estimating the value of forest land in Greece - Detailed Manual. Hellenic Agricultural Organization "DEMETER", Institute of Mediterranean Forest Ecosystems and Forest Products Technology, Athens

Bekri, E., Disse, M., Yannopoulos, P., 2015a. Optimizing Water Allocation under Uncertain System Conditions for Water and Agriculture Future Scenarios in Alfeios River Basin (Greece)—Part B: Fuzzy-Boundary Intervals Combined with Multi-Stage Stochastic Programming Model. Water 7, 6427–6466. https://doi.org/10.3390/w7116427

Bekri, E., Disse, M., Yannopoulos, P., 2015b. Optimizing Water Allocation under Uncertain System Conditions in Alfeios River Basin (Greece), Part A: Two-Stage Stochastic Programming Model with Deterministic Boundary Intervals. Water 7, 5305–5344. https://doi.org/10.3390/w7105305

Bekri, E.S., Yannopoulos, P.C., 2012. The Interplay Between the Alfeios (Greece) River Basin Components and the Exerted Environmental Stresses: a Critical Review. Water Air Soil Pollut 223, 3783–3806. https://doi.org/10.1007/s11270-012-1148-y

Ciancio, O., Corona, P., Marinelli, M., Pettenella, D., 2007. Evaluation of forest fire damages in Italy. Accademia Italiana di Scienze Forestali, Corpo Forestale dello Stato, Coppini, Firenze

Joint Ministerial Decision 135275 (no. 3, par. 9), 2017. Approval of general rules of costing and pricing of water services. Method and procedures for recovering the cost of water services in its various uses, Government Gazette 1751.

Cheminal, A., Kokkoris, I. P., Zotos, A., Strid, A., & Dimopoulos, P., 2022. Assessing the Ecosystem Services Potential of Endemic Floras: A Systematic Review on the Greek Endemics of Peloponnese. Sustainability, 14(10), 5926.

Dimopoulos, P., Bazos, I., Kokkoris, I.P., Zografdis,A., Karadimou, E., Kallimanis, A.S., Raus, Th., Strid, A., 2020. A Guide to the Alien Plants of Greece with Reference to the Natura 2000 Protected Areas Network, 112 p. Athens.

Kokkoris, I.P., Mallinis, G., Bekri, E.S., Vlami, V., Zogaris, S., Chrysafis, I., Mitsopoulos, I., Dimopoulos, P., 2020. National Set of MAES Indicators in Greece: Ecosystem Services and Management Implications. Forests 11, 595. https://doi.org/10.3390/f11050595

Kotsiras, K., Kokkoris, I., Strid, A., Dimopoulos, P., 2020. Integrating Plant Diversity Data into Mapping and Assessment of Ecosystem and Their Services (MAES) Implementation in Greece: Woodland and Forest Pilot. Forests 11, 956. https://doi.org/10.3390/f11090956

Kozanis, S., Efstratiadis, A., 2006. Zygos: A basin processes simulation model, in: 21st European Conference for ESRI Users. Greece