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A conceptual framework to link some soil concepts: Soil Quality, Soil Health, Soil-based Ecosystem Services, Soil threats. A proposition from the EJP SOIL – SERENA project

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The EU Soil Strategy aims at providing EU soils in a healthy state by 2050, with the intermediate objective of 70% of healthy soils by 2030. This ambitious objective urges both the monitoring of Soil Quality and Health over the whole of Europe, and the development of sustainable management practices to restore degraded soils. The links between some soil concepts remain unclear and limit the evaluation of management practices to improve Soil Health and Quality. In the framework of the EJP SOIL programme, the SERENA project developed a framework to interconnect a set of key concepts like Soil Quality, Soil Health and Soil Ecosystem Services, and Soil Threats. Some definitions have first been browsed from the literature, and adaptations/syntheses have been proposed and ranked by the SERENA project participants in order to arrive at a set of definitions supported by scientist from participating EU countries. A conceptual framework has then been proposed, initially based on the framework proposed by the EJP SOIL project SIREN. It is mainly based on a 2 interlinked boxes representation, combining the ecosystem and the socio-economic system. Ecosystem Services (ES) are considered both as a supply, from the ecosystem, or as a use, by the socio-economic system, which is the part of the ES supply directly or indirectly used or experienced by the society (farmers, institutions, whole population). The Natural Soil Capital, consisting mainly as the below-ground processes and functions, determines the ES supply by the whole ecosystem under specific conditions and type of use, together with the aboveground processes and functions associated to the other components of the ecosystem. Society is also responsible for the pressures on the whole system: it can either increase threats on soils (through the increase of cultivated land areas or intensification of agricultural practices, for example), or improve Soil Quality, Soil Natural Capital, and ES supply (thanks to agricultural practices increasing soil carbon stocks, for example). The main originalities of the SERENA frameworks are: i) to consider both Soil Quality and Soil Threats at the interface between the ecosystem and the socio-economic system, ii) to conceptualise a Soil Health threshold as a specific level of Soil Quality to define either healthy or unhealthy soils. The proposed conceptual framework of the SERENA project is open to discussion in the whole Soil Science community. A common and shared framework as such would enable a homogeneous and more structured research about soil ecosystem services and a better communicability to policy-

makers and the general public.