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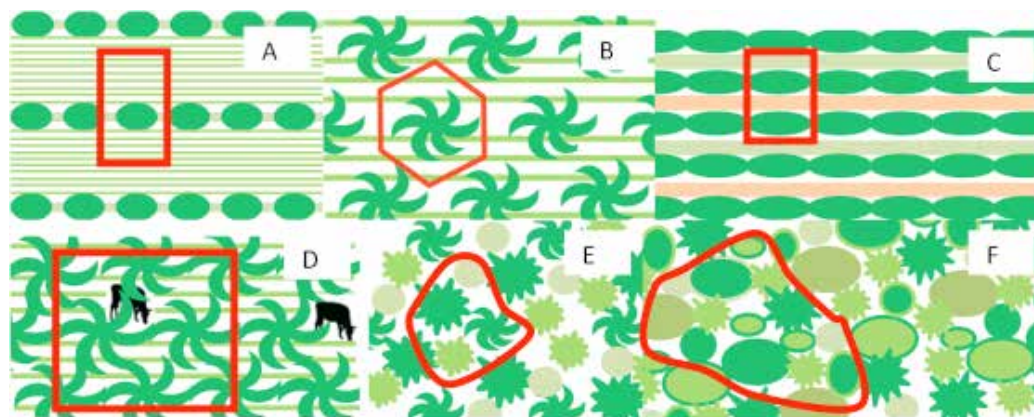


Ecosystem services functional motif: a new concept to analyse and design agroforestry systems

Rafflegeau S.¹ (sylvain.rafflegeau@cirad.fr), Allinne C.², Barkaoui K.³, Deheuvels O.⁴, Jagoret P.¹, Garcia L.⁵, Gosme M.⁶, Lauri P.-E.⁶, Mérot A.⁶, Metay A.⁷, Mézière D.⁶, Saj S.⁸, Smits N.⁶, Justes E.¹

¹Cirad - UMR System, Montpellier, France; ²Cirad - UMR System, Turrialba, Costa Rica; ³Cirad-UMR System, Rabat, Maroc; ⁴Cirad - UMR System, Lima, Perou; ⁵Cirad - Montpellier SupAgro - UMR System, Montpellier, France; ⁶INRA - UMR System, Montpellier, France; ⁷Montpellier SupAgro - UMR System, Montpellier, France; ⁸Cirad - UMR System, Guyane, France

Agroforestry systems (AFS) are multi-species systems comprising cropped and associated spontaneous species, including trees. The species in AFS provide different levels of regulating, supporting and provisioning ecosystems services (ES). We assume that the provision of ES depends on the functional characteristics of all associated species and their spatial layout in the AFS, which we call here the “functional motif”. We propose the concept of Ecosystem Service Functional Motif (ESFM) defined as the smallest spatial unit that is relevant to understand the provision of all the targeted ES, at a given time. This ESFM is useful to determine the smallest scale at which data should be collected for relevant upscaling of AFS functioning. As a proof of the ESFM concept, we use it to describe existing AFS covering a wide range of species richness X spatial organisation. We show, for each AFS, the ESFM for various types of targeted (multiple) ES at various stages in the development of the system. We finally discuss the strengths and weaknesses of the ESFM concept for (i) analysing the AFS functioning, (ii) designing improved AFS according to ES targeted, and (iii) modelling such AFS.



Examples of ESFM in different types of AFS: simple AFS with tree rows and a single crop in the alleys (A, B), alternate interrows of service crops in vineyard (C), silvopastoral AFS (D), complex AFS (E) and home garden (F). Surrounding redlines delimit ESFM in each example.

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