**Titolo del progetto:** HazelNUT biowaste-based technological tools supporting agroecosystem and forestry uses

**Acronimo:** NUTISFORU

**Bando:** MUR PRIN Bando 2022: PROGETTI DI RICERCA DI RILEVANTE INTERESSE NAZIONALE (Decreto Direttoriale n. 104 del 02-02-2022). Progetto “NUTISFORU” identificato con il Prot. 202277NXZY e approvato con Decreto Direttoriale n. 1048.14-07-2023.

**Codice Progetto:** Prot. 202277NXZY

**Finanziamento:** 259,423,00 € (Contributo totale) – 104,933,00 € (Contributo UNITUS)

**Durata del progetto:** 24 mesi

**Inizio:** 12/10/2023

**Codice Unico di Progetto (CUP):** J53D23009640006

**Partners:**
- Università degli Studi della Tuscia - DIBAF (Capofila), Viterbo (Prof. Giuseppe Scarascia Mugnozza; Dr. Fabrizio De Cesare)
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- Università degli Studi di Napoli Federico II - DICMAPI, Napoli (Prof. Giuseppina Luciani, Prof. Raffaele Marotta, Silvana Cangemi)

**Responsabile del progetto:** Prof. Giuseppe Scarascia Mugnozza - UNITUS

**Project background:**
The sustainability of agroecosystems has become a mandatory goal for the planet's safety. The circular bioeconomy model is based on the reuse and valorisation of by-products within the production of renewable biological resources and the conversion of these resources and waste streams into value-added products. In the agri-food sector, hazelnut cultivations are characterised by large amounts of waste (e.g. pruning, husks, shells and skins); valorising such materials is a great challenge. Possible reuses of these various wastes include energy recovery (biofuel and incineration), production of soil organic amendments (compost), food ingredients, biopolymers (lignocellulose-LC), antioxidants and antimicrobials (polyphenols-PP and flavonoids-FL).

**Project aims:**
The Project NUTISFORU aims at creating different functional products for applications in agriculture and forestry as biowaste valorisation of hazelnut residues as follows:
1. NUTISFORU will use electrospinning (ES) technology to link together organo-mineral nanocomposites obtained from the combination of lignocellulose, cellulose and lignin (LN) with hydroxyapatite nanoparticles, ultimately resulting in reliable increased C-stock.
2. NUTISFORU will create nanobiopesticides by encapsulating flavonoids (FL) and polyphenols (PP) from hazelnut biowastes into electrospun mats that will be tested against phytopathogens (fungi and bacteria), especially those of hazelnut trees.
3. PP, FL, and LN account for the highest antioxidant and antimicrobial activities among hazelnut compounds, so they will be recruited to develop safer multicomponent, multilayered, and multifunctional electrospun nanocoatings that act as wood protectants.

**Expected results:**
NUTISFORU ultimately intends to apply a circular bioeconomy model to agroecosystems through the valorisation of different hazelnut by-products and wastes for the development of a wide range of
value-added products from bioactive substances and soil matrices contributing to sustainable agriculture to wood value chain compounds like low-impact wood protectants.