# Long Term Ecological Research (LTER- Palestine)

## Site: LTER-Wadi Al Nar

**By: Dr. Jawad Shoqeir**

**Mrs. DiyaaRadaida – filed researcher**

**Miss DuhaAwad – Msc**

**Miss Israa Al – Assa - Msc**

## Introduction:

Every species on earth depends on soil for their survival. Soil is aprecious resource, yet most of us pay little attention to the soil under our feet. It is the medium in which we grow our food and the foundation on which we build our cities. Soils filter our water, detoxify our pollutants, decompose our waste and hold vast reserves of the nutrients required for life. In order to understand these mechanisms and the ongoing change, it is necessary to study ecological systems. The state of ecological systems that are composed of complex biological and physical components can be depicted using ecological integrity (EI) theory and critical zone (CZ) paradigm.

EI theory is based on changes in ecosystem properties during system development and disturbance. It integrates the components of physical, biological, and chemical properties and their robust interaction within the ecosystems to represent a holistic view of the ecosystem state.

CZ is an integrated framework for studying life supporting systems. CZ comprises the zone between bedrock and the atmospheric boundary,i.e. “the heterogeneous, near-surface environment in which complex interactions involving rock, soil, water, air, and living organisms regulate ecosystem processes and determine the availability of life-sustaining resources."The CZ framework reflects the significance of scientific interdisciplinary studies that link earth and ecological disciplines as a precondition for tackling the challenges of land-use change impacts on ecosystems functioning. Effective management actions and policy decisions about the CZ require information on the status, condition, and trends of ecosystems. Multiple levels of scientific information are needed to understand the functioning of the CZ and to make effective management decisions, specifically in disturbed sensitive water limited systems.

This project investigates the CZ function and its EI in water-limited catchments in Palestineand develops a theoretical and experimental framework that summarizes the condition of the ecosystems embedded in the catchments so that changes can be tracked over time. Information gained will be utilized as a tool to support environmental management and decision for low EI ecosystems.

The overall aim of the project is to study the structure, function, and dynamics of the CZ, under various land-uses, in water-limited systems, and evaluate its EI. This is in order to enhance the rational management of water, soil, and biological resources of dry lands for the benefit of humans and their environment. This aim will be implemented in watersheds in Palestinian semi-arid areas (Wadi AL Nar catchment).

Specific objectives of the project are as follows.

1) To develop a robust, transferable, and cost-effective interdisciplinary monitoring, experimental, and modeling LTER program that integrates a conceptual-methodological framework to identify spatial patterns of the functional dry land CZ using EI theory.

2) To study, in the CZ, soil functions (e.g. infiltration capacity, soil water retention) water cycling (e.g. rainfall-runoff-soil moisture- evaporation-transpiration) the function of the biotic ecosystem engineers (e.g. their role in soil and water conservation and leakage) and their integrated effect on geodiversity and biodiversity, ecosystem function, EI and ecosystem services at the catchment scale.

3) To provide a functional representation of the CZ and its EI, driven by soil functions and ecosystem biotic engineers in complex landscape mosaic of dry lands.

To achieve these objectives we identify three research topics based on ExpeER protocols:

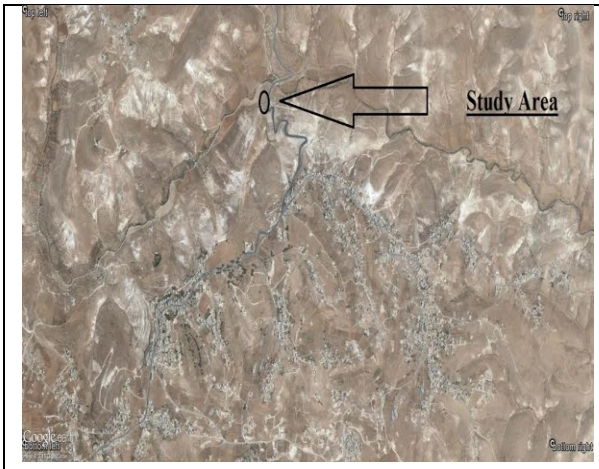
1. Assessing Ecosystem Responses to Land-use Changes by Soil Quality index:
2. Assessing the effect of land-uses transformation on ecosystemfunctions(Fauna diversity).
3. Tea Bag Index: The TeaBag decomposition initiative,

To carry on these research topics, four specific research questions were identified to be studied empirically based on EI theory and CZ paradigm,

i. What are the factors controlling water, soil, and organisms' spatial and temporal redistribution within Wadi Al Nar".
ii. How do water, soil, and biota source-sink processes, driven by physical and biotic patchy landscapes affect CZ functioning and EI of the landscape mosaic?
iii. What are the factors controlling conservation and leakage of resources (water, soil, nutrients) at the slope and the catchment scales and how they regulate CZ functioning and EI of the landscape mosaic?
iv. How the functional relationships between geodiversity and biodiversity controls processes and feedbacks of the CZ and what are the consequences in terms of EI?

**Study area:**

The study area stretches from the town of Silwan East Jerusalem through areas Sawahara to the Dead Sea. Ubaydiah is a Palestinian town located to the East of the city of Bethlehem with an altitude of 532 meters above sea level, with an averageannual rainfall of about 246 mm, (Arij2008/2009). Figure 1 represents the LTER-Wadi Nar test site location,where a4000 $m^2$study field was donated by the Ubaydiah municipality to carry out the research for 10 years.



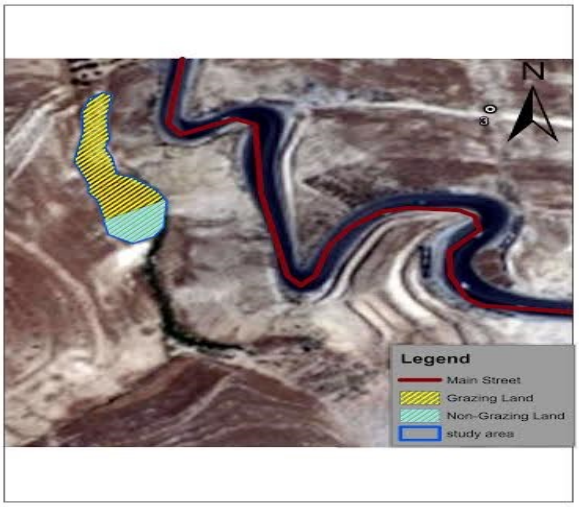




**Figure1: LTER-Wadi Nar test site, the yellow color represent grazing field and the blue color represent the none grazing field.**

**LTER-Wadi Nar as Part of ILTER network**

**In Jan. 2015, establishment of the LTER site (figure 2) through funding by the Amuta for Education and Health(two MsC students) and enabling Dr. Jawad Shoqier to attend the ILTER Annual meeting – Rome, Italy, 24-30 September 2015 to start the process of joining International LTER (figure3).**

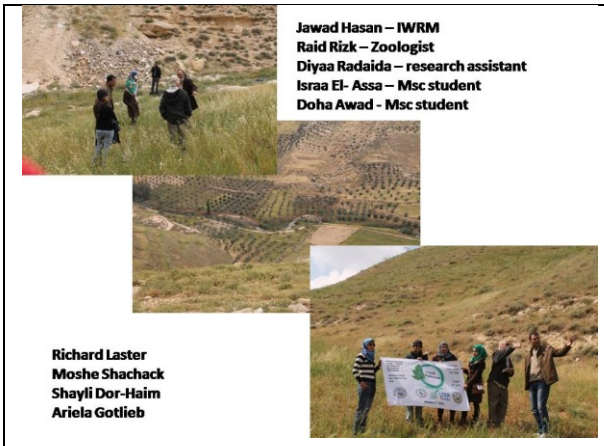
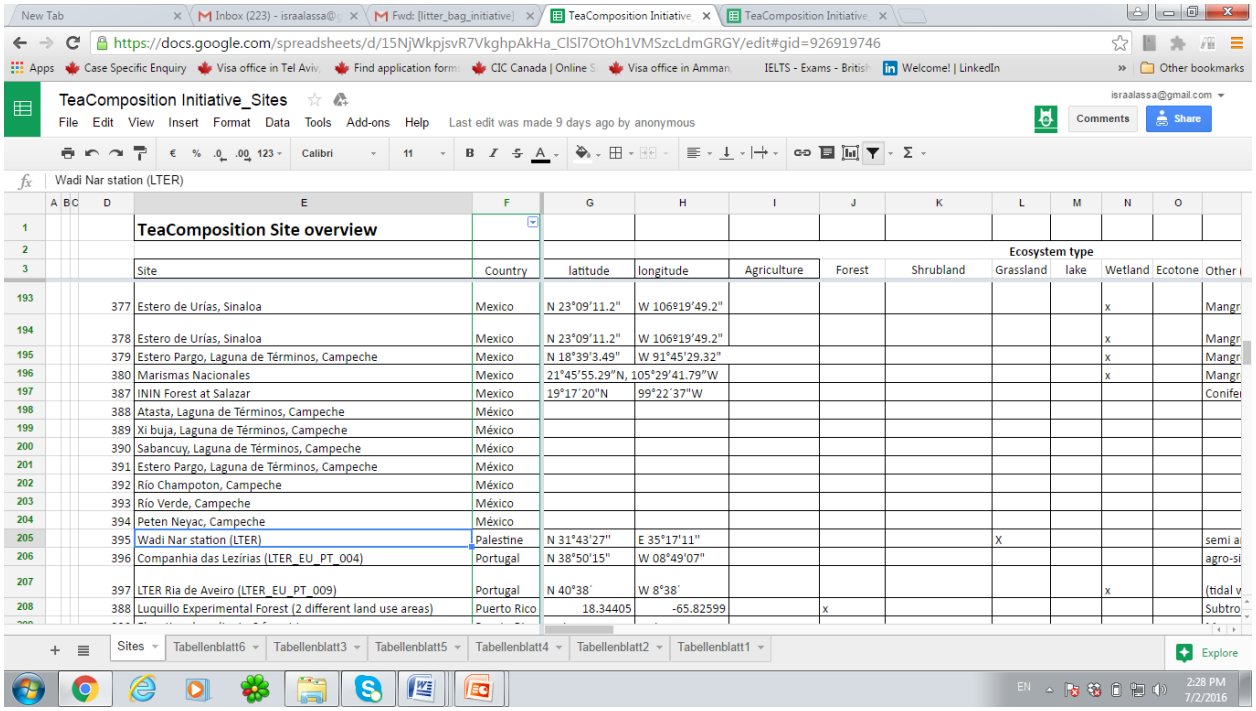



**Figure 2: Prof. Mosha Shahak staff, Ubaidieh staff, Dr. Shoqier's staff choosing the field site.**

**Figure 3: the upper left photo is the Italian LTER site, the other two photos are equipments and sampling activity at the LTER-Wadi Nar site**

**As a result LTER-Wadi Nar managed to join the Tea Bag composting site initiative along with other 700 sites in the world, LTER-Wadi Nar was given number 395 as part of the ILTER (table 1).**

**Table 1: explains the names, locations and site information world wide of the 700 ILTER sites involved in the TeaBag initiative.**



TeaComposition Initiative_Sites

Wadi Nar station (LTER)

**TeaComposition Site overview**

| | Site | Country | latitude | longitude | Agriculture | Forest | Shrubland | Grassland | lake | Wetland | Ecotone | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Ecosystem type | | | | |
| 377 | Estero de Urías, Sinaloa | Mexico | N 23°09'11.2" | W 106º19'49.2" | | | | | | x | | Mangr |
| 378 | Estero de Urías, Sinaloa | Mexico | N 23°09'11.2" | W 106º19'49.2" | | | | | | x | | Mangr |
| 379 | Estero Pargo, Laguna de Términos, Campeche | Mexico | N 18°39'3.49" | W 91°45'29.32" | | | | | | x | | Mangr |
| 380 | Marismas Nacionales | Mexico | 21°45'55.29"N, | 105°29'41.79"W | | | | | | x | | Mangr |
| 387 | ININ Forest at Salazar | Mexico | 19°17´20"N | 99°22´37"W | | | | | | | | Conifer |
| 388 | Atasta, Laguna de Términos, Campeche | México | | | | | | | | | | |
| 389 | Xi buja, Laguna de Términos, Campeche | México | | | | | | | | | | |
| 390 | Sabancuy, Laguna de Términos, Campeche | México | | | | | | | | | | |
| 391 | Estero Pargo, Laguna de Términos, Campeche | México | | | | | | | | | | |
| 392 | Río Champoton, Campeche | México | | | | | | | | | | |
| 393 | Rio Verde, Campeche | México | | | | | | | | | | |
| 394 | Peten Neyac, Campeche | México | | | | | | | | | | |
| 395 | Wadi Nar station (LTER) | Palestine | N 31°43'27" | E 35°17'11" | | | | X | | | | semi a |
| 396 | Companhia das Lezirias (LTER_EU_PT_004) | Portugal | N 38°50'15" | W 08°49'07" | | | | | | | | agro-si |
| 397 | LTER Ria de Aveiro (LTER_EU_PT_009) | Portugal | N 40°38´ | W 8°38´ | | | | | | x | | (tidal v |
| 388 | Luquillo Experimental Forest (2 different land use areas) | Puerto Rico | 18.34405 | -65.82599 | | x | | | | | | Subtro |

**Methodology:**

**I. Assessing the effect of land-uses transformation on ecosystemfunction(Fauna diversity):**

Fauna played an important role in the soil quality due to the chemico-physical and biological processes that are rooted in the soil. Soil ecosystems generally contain a large variety of animals, such as nematodes, micro arthropods such as mites and Collembola, Symphyla, Chilopoda, Pauropoda, enchytraeids and earthworms. Arthropods are living in the upper layer of soil. They play major role of recycling of organic matter, energy and nutrients.

**The objective to cope with ExpeER protocol - ways to study fauna**

1- Study the diverse of fauna in wadi Al-nar

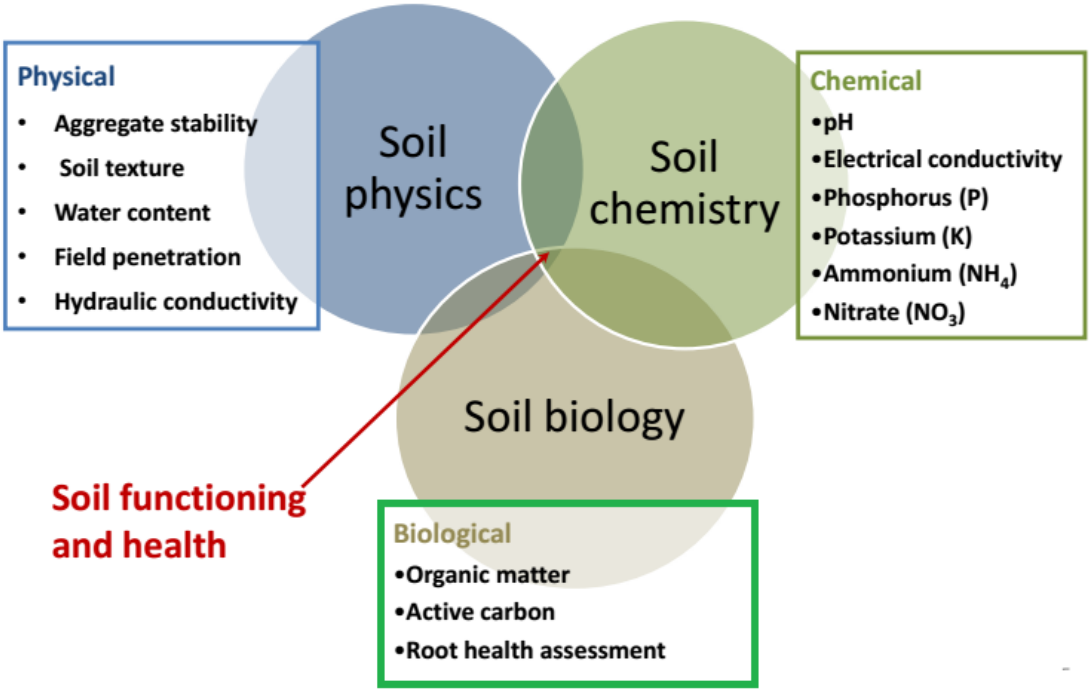
2- Diverse arthropods species and comparison between them

3- Study the effect of fauna on soil Quality

## II. **Assessing Ecosystem Responses to Land-use Changes by Soil Quality index**:

Soil is the essential ingredient in the ecosystem of the land where the ecosystem is affected by processes that get in the soil through the ozone layer, global warming, rain, pollution, destruction and water. The soil is the habitat of living organisms, where each gram billions of organisms belonging to thousands of species.Ecosystem responses to changes that occur in land use is a term that includes a wide range of human activities on the earth's surface, such as grazing and agriculture. Since the change in land use have a significant impact on the ecosystem responses in terms of ecosystem structure, this creates a new and complex relationship between the soil and the plants that determine the health of the ecosystem interactions.This study is based on the assumption that soil and vegetation are the most important aspects and the impact on the ecosystem response and change in land use significantly affects key aspects of the responses of the ecosystem. It proposes several ways to combine measurements as indicators of the soil and converted to a digital index and the purpose of this indicator is to monitor changes in the soil or to compare the soil in different places and this assess the effects of different groups of management practices.

**The objective to cope with ExpeER protocol – is to construct a soil index to correlate land use activity to a healthy ecosystem.**



III. **Tea Bag Index: TeaBag decomposition initiative, Way to Decomposition Data Collect (the protocol is in progress to be translated into the Arabic language; then it will be published on the ILTER website)**

The Teabag experiment willprovide vital information on the global carbon cycle by using teabags. The decay of organic material is a critical process for life on earth. Through decomposition, nutrients become available for plants and soil organisms to use as a food source in their metabolism and growth. When plant material decomposes, it loses weight and releases the greenhouse gas carbon dioxide ($CO_2$) into the atmosphere. In cold environments, breakdown is slower than in warm environments, meaning more carbon is stored in the soil and less CO2 is released. Factors like moisture content, acidity, or nutrient content of soils can also influence how quickly plant material decomposes, which makes it quite difficult to predict the actual decomposition of a soil.The experiment is divided into two parts: lab and field. Part one will be held in the SHR lab at AL-Quds University and the second part inWadi-Al Nar, to measure the impact of water types on teabags' decay by using tap water, olive mill waste water (zebar and treated zebar), wastewater.

**Next steps:**

1. Fund raising to support the 2 Msc students and one PhD student.
2. Fund raising for field equipment upgrading and ExpeER protocol implementation.
3. Forming management comity, scientific comity, stakeholder commitment.
4. More collaboration with local and international LTER sites
5. Submit the application to join EU- LTER