

# Long-term decomposition study: Engaging middle and high school teachers and students in international collaboration and data sharing

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## Project Overview

The Long-Term Decomposition Study was initiated by the LTER-EDU, an educational project lead by the Israeli LTER site that offers school students a chance to be partners in the Long-Term Ecological Research (LTER) global monitoring effort. The students collect meteorological data and monitor decomposition, vegetation, arthropods, butterflies, birds, and other data. The monitoring has taken place in schools in Israel, Bulgaria, Greece, Portugal, and now several schools in Oregon. Through workshops and collaboration, teachers in Oregon have developed long-term litter-bag decomposition studies to which students contribute data each year. With the project’s initiation in Oregon in the fall of 2013, teachers and students have a unique opportunity to collaborate and share data. Because schools in a variety of ecosystems are involved, students learn about factors that affect how nutrients cycle and the impact of climate on carbon cycles and ecosystems in general. Students act as scientists and contribute to discoveries that can be shared among multiple schools, and they see their efforts reaching farther than their own individual learning and growth.

## Project Protocols

Participating schools follow protocols developed by LTER-EDU Global Monitoring project researchers at Ramat Hanadiv LTER site in Israel for measuring the rate of leaf litter decomposition. The method involves placing a known mass of plant litter into fiberglass net bags (20 X 20 cm), collecting the bags at monthly intervals, and measuring weight loss over time. Details include the following:

1. Students collect recently-dropped leaf litter nearby their study area.
2. In the laboratory, the litter is separated into components: leaves; branch parts; flowers, seeds and fruit. Each bag is tagged with a specific number, date, name of group representative. A similar “dose” of litter, with a total mass close to 5 grams, is placed in each net bag, and stapled shut.
3. At least ten net bags are placed in each monitoring area. On each of the five monitoring dates, one pair of net bags is collected from the field.
5. Litter is dried in a paper bag in a drying oven for at least 24 hours at a temperature of 55°C.
6. Litter is weighed and data recorded in the Google Data Sheet form and uploaded to Ramat Hanadiv web site at the end of the year.



## Participating Schools Highlights

### Sandy High School

The Sandy High School students made leaf litter bags containing 4-6 g of Big Leaf Maple (*Acer macrophyllum*) leaves that were near the point of falling from the tree. Each class put sets of 10 leaf litter bags in the field. Two sets were placed in forested areas, two were placed in grassy areas, one set was placed in the crawl space under the building, and the last was submerged in the pond on campus. Each month, the students collected two of these bags and measured the dry weight of the leaves. Each student was also given two leaf litter bags of their own and they determined the variable (bag placement, litter material, time, etc.) that they wanted to test.



### Sisters High School

For the past two years, Sisters High School biology students have made leaf litter bags containing 3-5 g of Ponderosa pine (*Pinus ponderosa*) needles that had recently fallen. Each year, 19 small groups of students each placed five linked bags on the ground of a local Ponderosa forest (high desert ecosystem). One bag from each chain was collected one month, three months, and six months following placement. Students weighed the dried litter and recorded the data on the group Google form. Each group also chose another carbon-based material (plastic bags, paper towels, cloth, plastic utensils, etc.) to compare to the native Ponderosa pine leaf litter.



### Rachel Carson Environmental Middle School

For the 2013/14 school year, decomposition bags were placed in three different locations on school property next to Douglas Fir forest and Willow Creek. The site is near the lower baseball field with a mix of grasses, Himalayan blackberry and mature forest. The locations included: the base of a Douglas Fir tree, within Himalayan blackberries, and in the open grass field.

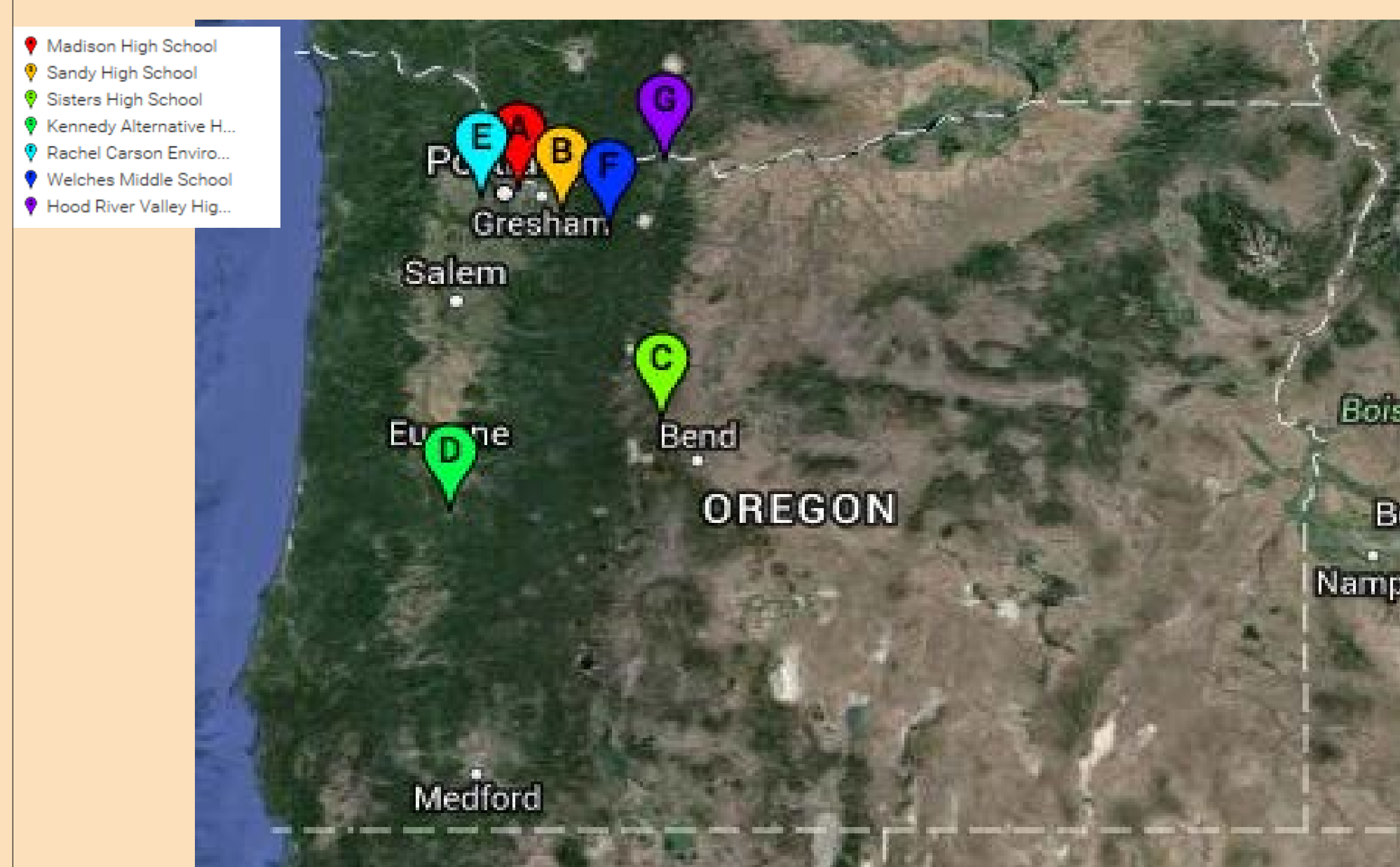
## Workshops and Collaboration

Oregon Natural Resources Education Program (ONREP) workshops brought potential participating teachers together to learn about the LTER-EDU Decomposition Study protocols. In workshops on February 2013 and May of 2014, teachers practiced making the litter bags, collecting litter, examining forest litter, and identifying decomposing organisms. Teachers also learned about current research at HJ Andrews and OSU. They collaborated together, developing ideas for incorporating decomposition-related curriculum into existing classes. Together they built a Google form for collecting data that would enable all participants to access and analyze the data for multiple years.



Teachers participating in the LTER-EDU Long-Term Decomposition Study workshops. Photos by Lina DiGregorio.

## Participating Schools in Oregon



From OSU ONREP Decomposition Project website:  
<http://onrep.forestry.oregonstate.edu/decomposition-project>

## Data

Students enter mass of litter once collected and record data in Google form. Data can then be accessed and analyzed by all participants.

ONREP Decomposition Project Student Data Sheet

**\*\* Required \*\***

Name \*  
Last, first:

School Site \*  
Click on your school:

What grade level? \*

What period are you in? \*

Date bag was placed at site \*  
mm/dd/yyyy

Date bag was collected from site  
This can be entered later after the bags are collected.  
mm/dd/yyyy

Bag number \*  
Enter whole number only:

Decomposition Material \*  
☐ Maple leaves  
☐ Douglas Fir needles  
☐ Ponderosa Pine needles  
☐ Mixed deciduous forest litter  
☐ Mixed conifer forest litter  
☐ Oak  
☐ Nonorganic  
☐ Other:

Material type \*  
☐ Douglas Fir Forest  
☐ Huckleberry/Graze  
☐ Ponderosa Pine Forest  
☐ High Desert Scrubland  
☐ Aspen  
☐ Urban (parkways, parking lots, etc.)  
☐ Other:

Bag Placement \*  
☐ Surface  
☐ Hanging  
☐ Buried  
☐ Underwater  
☐ Other:

Original mass (g) of the leaf litter \*  
This should be measured outside of the bag.

Final mass (g) of the leaf litter  
This should be measured outside of the bag. This could be done after bags are collected.

	A	B	C	D	E	F	G	H	I
1	School Site	Date bag was placed at site	Date bag was collected from site	Bag number	Decomposition Material	Habitat type	Bag Placement	Original mass (g) of the leaf litter	Final mass (g) of the leaf litter
2	Sandy High School	11/21/2014	12/17/2014	271	Maple leaves	Douglas Fir Forest	Surface	5.03	3.6
3	Sandy High School	11/21/2014	12/17/2014	11	Maple leaves	Douglas Fir Forest	Surface	4.2	2.7
4	Sandy High School	11/21/2014	12/17/2014	180	Maple leaves	Douglas Fir Forest	Surface	4.4	3.2
5	Sandy High School	11/21/2014	12/17/2014	92	Maple leaves	Douglas Fir Forest	Surface	5.76	4.2
6	Sandy High School	11/21/2014	12/17/2014	220	Maple leaves	Douglas Fir Forest	Surface	6	4.3
7	Sisters High School	10/9/2013	10/31/2014	1798	Maple Card	Ponderosa Pine Forest	Buried	4.08	2.85
8	Sisters High School	10/9/2013	10/31/2014	1790	Ponderosa Pine need	Ponderosa Pine Forest	Surface	3.18	2.51
9	Sisters High School	10/9/2013	10/31/2014	830	Ponderosa Pine need	Ponderosa Pine Forest	Surface	5.22	4.03
10	Sisters High School	10/9/2013	10/31/2014	840	cardboard	Ponderosa Pine Forest	Surface	4.42	4.06
11	Sisters High School	10/9/2013	10/31/2014	811	paper towels	Ponderosa Pine Forest	Surface	3.44	3.35
12	Sisters High School	10/9/2013	10/31/2014	829	Ponderosa Pine need	Ponderosa Pine Forest	Surface	3.75	3.47
13	Sisters High School	10/9/2013	10/31/2014	1555	Ponderosa Pine need	Ponderosa Pine Forest	Surface	3.16	2.48

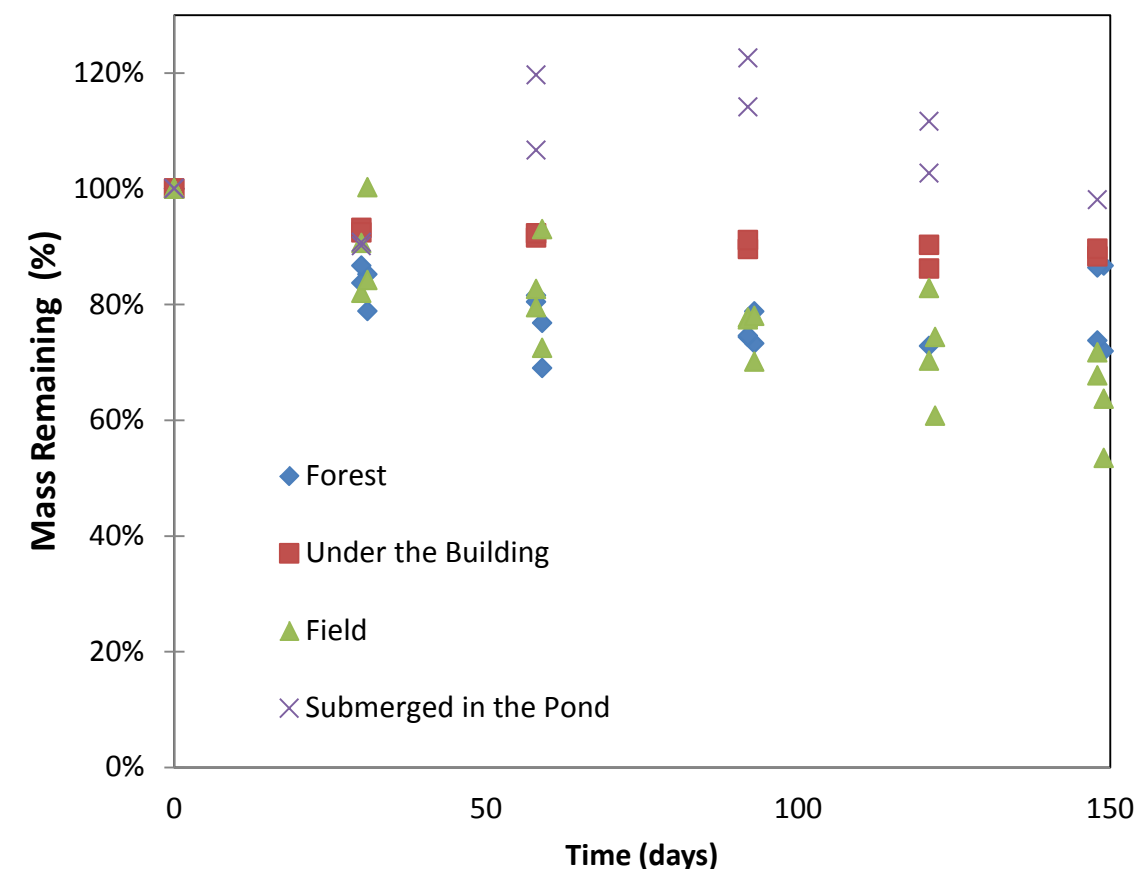


Figure 1. Mass of leaf litter remaining (%) as a function of time left in the field at Sandy High School .

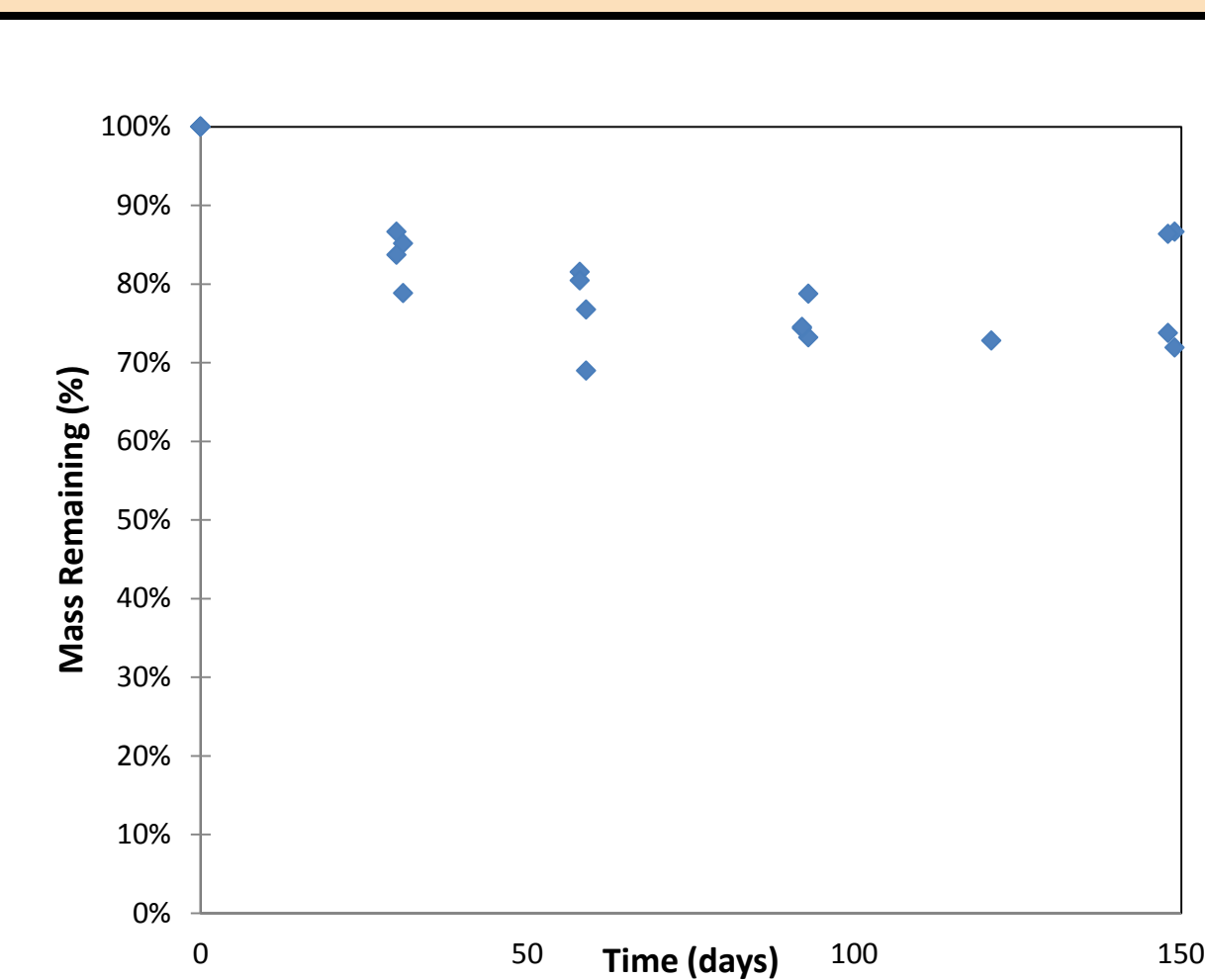
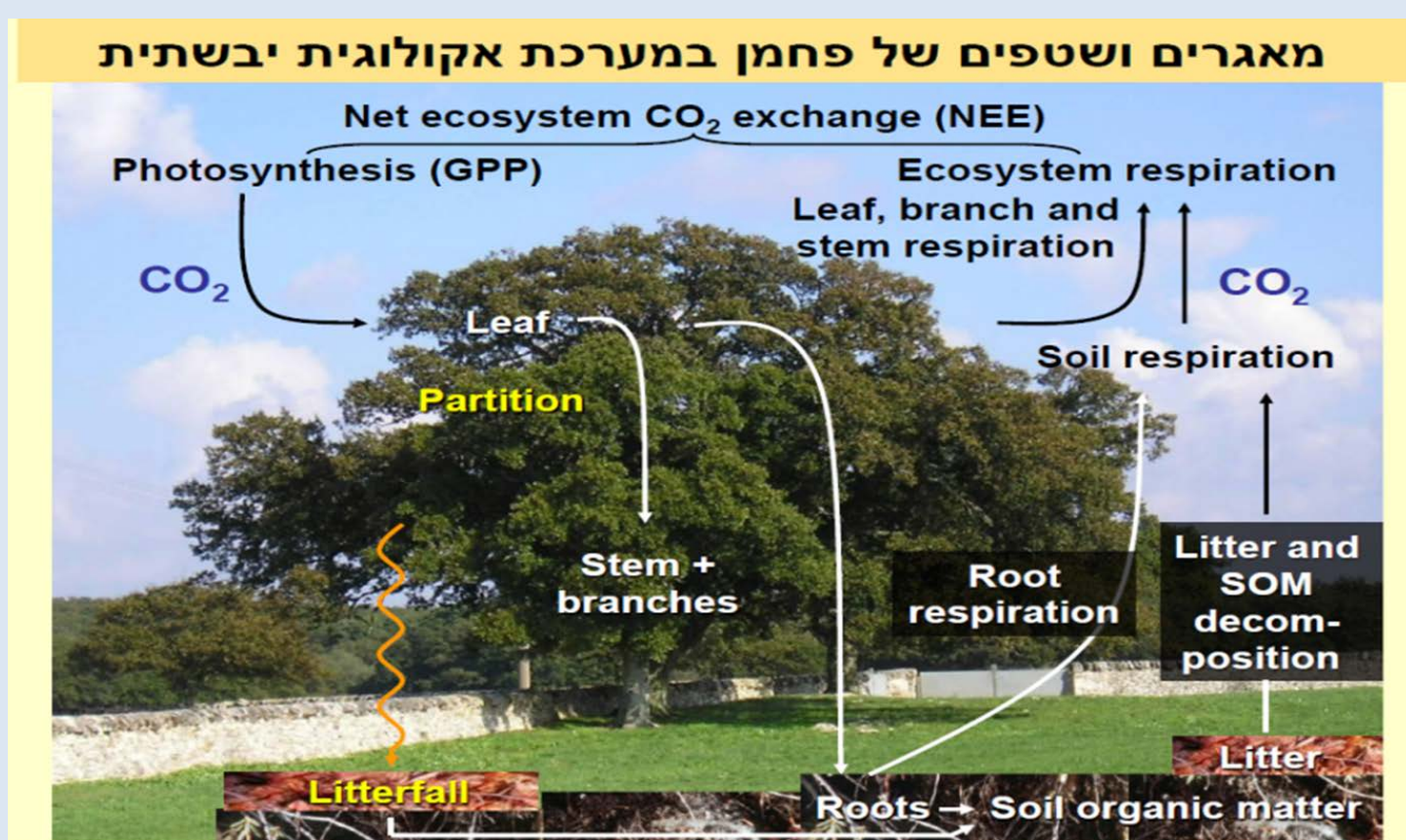


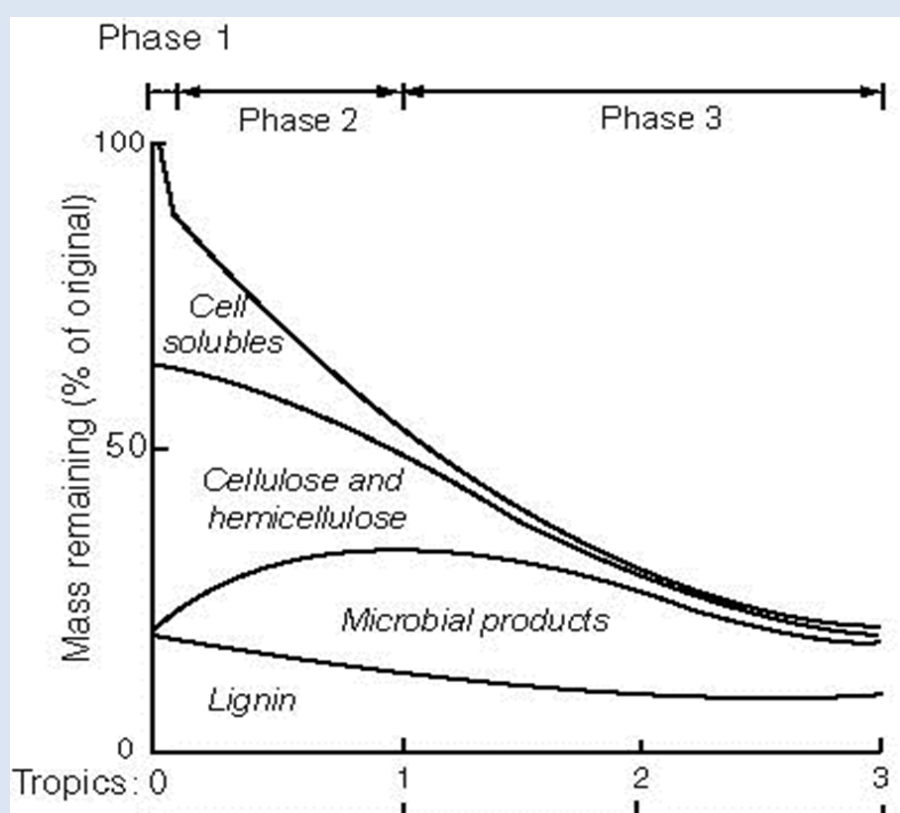
Figure 2. Mass of leaf litter remaining (%) as a function of time left in the field for two forest sites at Sandy High School.

## Decomposition and movement of Carbon

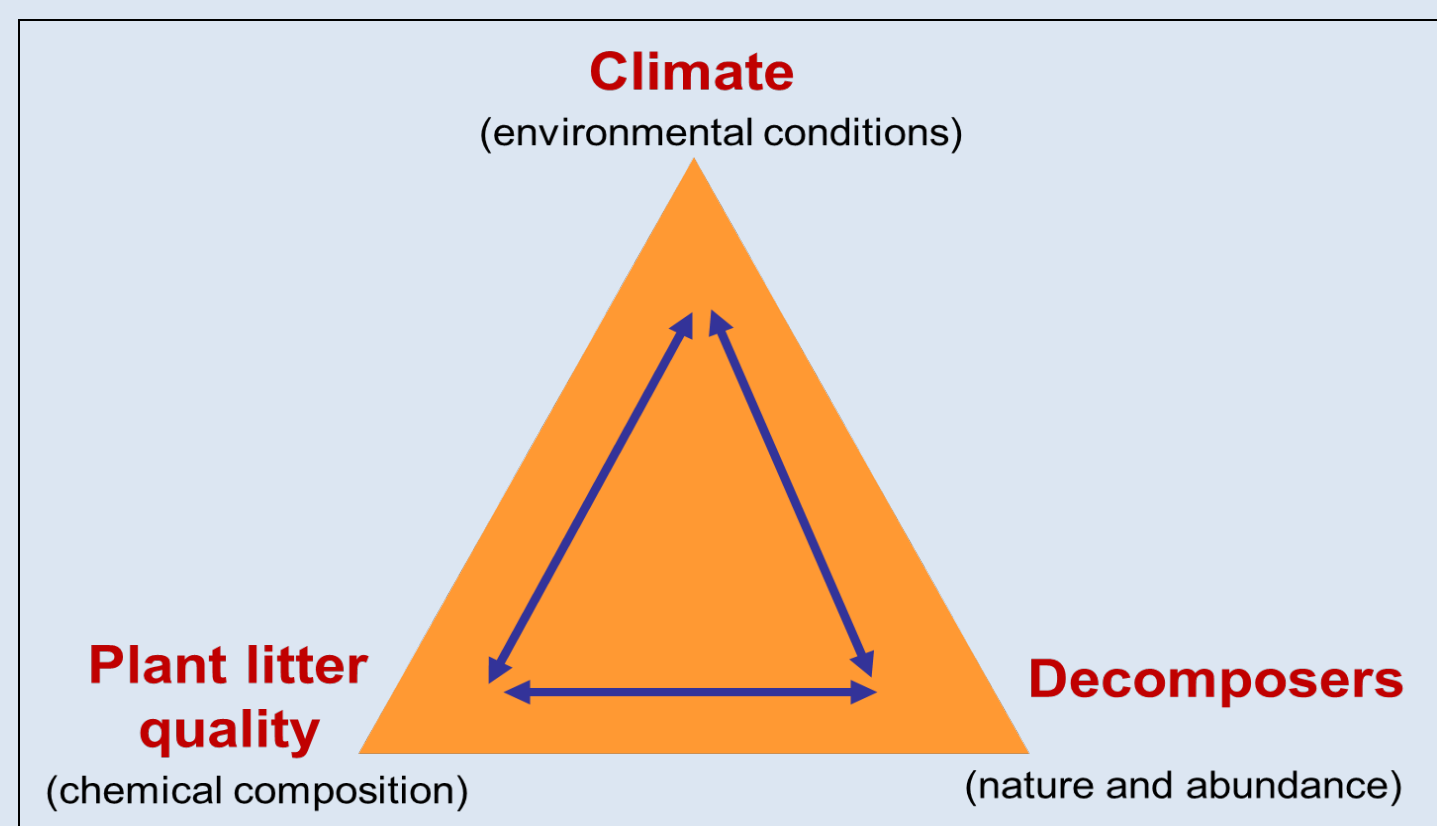


Decomposition moves carbon from solid form stored in dead material to gas in air. These diagrams were developed at Ramat Hanadiv in Israel for the LTER\_EDU and are used in classrooms in Oregon to introduce decomposition in the context of the carbon cycle to middle/high school students (Saleit Ron, pers. comm.)

## Phases of Decomposition



## Decomposition triangle



## Future Plans

After just over a year of collaboratively collecting data, participating teachers are tackling the challenge of analyzing data from multiple sites with their students. They plan to have their students regularly draw conclusions from the data as it builds and to submit the data to Israel to create connections with Israeli teachers. Kari O’Connell will invite other LTER sites to be involved in the project at the LTER All Scientists Meeting in September of 2015.

## Acknowledgements

Thanks to Mark Harmon, Jay Sexton, and Samantha Colby who shared their time and knowledge with middle and high school teachers for this project. Thanks to Saleit Ron and Jill Semlick whose vision and “right kind of craziness” inspired this project.



Sisters High School students set out decomposition bags. Photo by Rima Givot.

For more information, see:  
<http://onrep.forestry.oregonstate.edu/decomposition-project>