



**ECOSYSTEM SERVICES
OF THE IFUGAO RICE
TERRACES LANDSCAPE**

BOOK 2



Youth Capacity Building and Exchange Program Towards Sustainable Development and Conservation of Ifugao Rice Terraces: #Y4IRT Ayangan

Series Authors: Inocencio E. Buot, Jr., Ph.D., Consuelo D. Habito, Ph.D, Marissa P. Bulong, Ph.D., Mark Anthony F. Rabena, Thaddeus P. Lawas, Ph.D., Elpidio Basilio, Jr., Ph.D., Romeo A. Gomez, Jr., Ph.D., Melanie S. Subilla, Aurora V. Lacaste, Francis Mark Dioscoro R. Fellizar, Eulalie D. Dulnuan, Joane V. Serrano, Ph.D., Sherry B. Marasigan, Ph.D. & Martina B. Labhat, Ph.D.

Series Translators: Josephine G. Pataueg, Rebecca W. Bumahit & Gregorio Umingli

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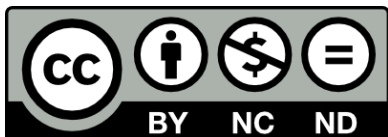


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BOOK 2

ECOSYSTEM SERVICES OF THE IFUGAO RICE TERRACES LANDSCAPE

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BOOK 2

ECOSYSTEM SERVICES OF THE IFUGAO RICE TERRACES LANDSCAPE

CHAPTER 1: HAY STRUCTURE DI ECOSYSTEM



OBJECTIVES

Nu magibfoh hitoy an maasha ja kaya/mafalin ju kuma an:

1. Maifaga ni mipanggep hi ihnay biyagna ja miid biyagna hi ecosystem;
2. Maifaga ni at'atton ni ihnay biyagna ja ni miid biyagna hi oha't oha hi ecosystem;
3. Maifaga ni nunsabasabaliyan ni predation, herbivory, competition ja symbiosis.

Shan inila ju an hay IRT Satoyama landscape ja ihna shah shi ni ihnay biyagna ja jahasi maid biyagna an ihnay aat sha oha't oha? Hay at'atton jahasi ihnay biyagna hi environments sha shashuy jahasi nunsabasabali an ecosystem anam'in hi IRT. Hay example an mattig hi ecosystem hi anam'in an IRT ja ihnay alah, pajaw, inuman ja gwanggwang. Hay aat shi ecosystem hi oha't oha ja mattig hi structure sha ja hi functions sa. Kasho'lan hi ojon sha an structure ja jahasi nagan shuy an ihna shi, hay function sha ja jahasi aton sha oha't oha ta munnanong an mi'ohha.

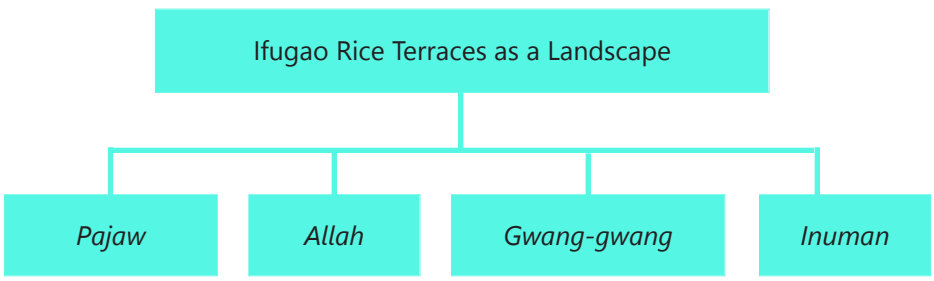


Figure 1. Jahasi munsabasabali an ecosystem hi IRT landscape.



Tapnu maat anam'in shi umatana an munnanong ni IRT ja importante an maawatan tau jahasi functions/ aat shi nunsabasabali an ihnah shi penhod nan ojon an aton taun namin ni mangipananong fu'un ja amuna ni pajaw mu pati ni alah ni ngilig, jahasi inuman ja gwanggwang. Jahatun ecosystem ja mun'ooaha sha ngunu (function) sha ta siguradun iihna latta ni IRT landscape.

Itoy an chapter ja asahalon tauy mipanggep hi ecosystem structure. Shan inila ju shatoy? Nu ashi adja ja, ashi aju madanagan ti itoy an chapter ja inilaon tau nu naganay ecosystem, nagana ta maifaga tau an hitoy an environment ja ecosystem ja nagana jahatun nunsabasabali an ecosystem.

Maashal pay itoy an chapter shi munsaba-sabalin aat jahatu an ihnah ecosystem. Shan penhod ju an inilaon jahatu?



Topic 1: Jahatu ni ihnay Biyagna ja ni miid Biagna



Hishuy latlatu ja ipattig na ni ecosystem. Ihna shi anam'in ni factor ta ahi maihnay ecosystem. Shan inila ju shatoy? Nu ashi ju adja, ja irugi tau an ashalon ni nahhun an ojon sha an basic concept an mipanggep hi ecosystem.



What is an Ecosystem?
<https://bit.ly/32nGEv7>

Shan nagibfoh jun tinnig ni video? Tigan tau ngana shi concept shi structure ni ecosystem. Hay ifagan shi video ja hay ecosystem ja ihna shah shiy ihnay biyagna ja maid biyagna. Tigan juh toy an video ta inilaon ju ni umatan jahatu.



Ecosystems and Biomes
<https://bit.ly/2YqQn2g>

Nu ungguy ju pay nakaawatan ja pigwon ju an buyaon/tigan ta ahi tau ituluy. Ngem nu inawatan ju adja ja ituluy tau.

Pon'ashalan 1

Ad uwan an inashal tauy mipanggep hi ecosystem ja jahashi ihnah shi, ja umuy tau munmangmang hi nunsinabasabali an ecosystem an ihnah nunhitugwan tau. Mafalin an umajag aju punkadwa ju ta umuy aju hi nunsabasabali an ecosystem ngem mahapo an ipakada ju hi tatagu an maah'upan ju ta ashi sha munnomnom hi sabali an naguni ta umuy aju. Ja munusar ajuh nibagay an lofong or hapin, ja alan ju ni camera ju ta ihnay punlatlatu ju. Hay nihegheggon ni umajan ju ta nu adja shimatong aju ja pinicture ju ni producer, consumer, ja decomposer. Tandaanan ju jahatun description: hay ngashan sha, himangagwan sha (ex. Tufu, luta, hapang ja fatu) ja nan miid biyagna an mun'apektar ay jahatu.

Inila ju mo an jahasi ihnay biyagna ja miid biyagna an ihnah ecosystem, ja inashal ju kuma an jahatun components ja ihnay at'atton shah oha't oha. Aga ta aton tauy pon'ennelaan nu nagan shuy ni ihnay biyagna an maki-interact hi miid biyagna, Athishi gu ni miid biyagna hi ihnay biagna.

Pon'ashalan 2

Mahun, paattiggon jahatu latlatu.



Itoy ihnah latlatu, inilaon ju nu nagana shi datin at'atton ni ihnay biyagna ja miid biyagna hi hino-ha.

SELF ASSESSMENT QUESTIONS:

Itusho' ju nan answer ju gway linya:

1. Hay ecosystem ja jahatu _____ ja _____ an ihnay landscape an jahatu ja ihnay at'atton shah oha't oha.
2. _____ ja jahatu ni mangamma ni anun sha, ja hay maudi ja decomposer an shishay mangusar hi natoy an intanum/plants ja taraken/animals.

Topic 2: Biotic Interactions

Ad uwan tigan tau nu nagana ni jahashi ihnay biyagna an makiinteract hi oha't oha. Tigan ju shi video ta inilaon ju.



Interactions between Populations
<https://bit.ly/2ULUFiJ>

Shan narpas an tinnig/binuya ju ni video. Paattiggon ju jahatu latlatu nu naganay nikamangan sha hi oha't oha. Ja i-expalin ju nu kasanu?



Hay maudi ja etau pay mun'adventure!

Pon’ashalan 3

Tigan ju jahana ecosystem hi neha’ashan ju ta umuy ju tigan shi ushum an example shi at’atton shi ihnay biyagnah oha’t oha. I-document ju shi at’atton sha hi oha’t oha an usaron juy camera ja selpon ju. Ja i-explain ju shi latlatu ja ibasar ju ni jahatun keypoints:

1. Sha’gu shi nunmangmangan ju shi at’atton sha oha’t oha. Ipainila ju nu naganan klase an ecosystem;
2. Ojon nu naganay ngashan jahatun organisms;
3. Paaifagga ju jahasi tinnig ju an at’atton shi oha’t oha.

SELF ASSESSMENT QUESTIONS:

Indicate the appropriate symbol to show how organism 1 interacts with organism 2. Write (+) for positive effect, otherwise, write (-) for negative effect.

Type of interaction	Organism 1	Organism 2
<i>Predation</i>	+	-
<i>Herbivory</i>		
<i>Competition</i>		
<i>Mutualism</i>	+	+
<i>Parasitism</i>		
<i>Commensalism</i>		

BOOK 2

ECOSYSTEM SERVICES OF THE IFUGAO RICE TERRACES LANDSCAPE

CHAPTER 2: ECOSYSTEM FUNCTIONS



OBJECTIVES

Nu magibfoh hitoy an chapter ja:

1. I-explain nu kas'anu ni energy an umuy hi ecosystem;
2. I-explain nu kas'anu ni sustansya (nutrients) (shanum/liting, carbon, nitrogen) an mausar hi ecosystem.

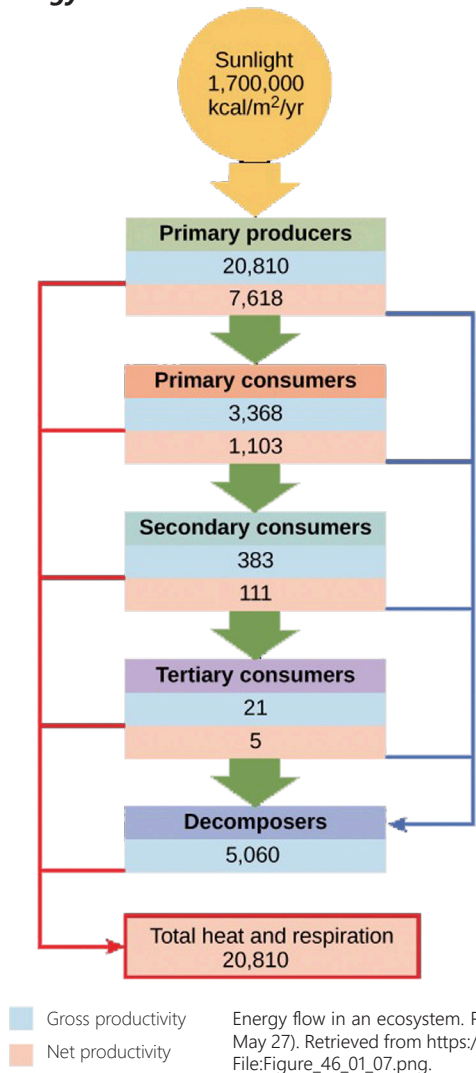


Inashal tau gway nagibfoh an chapter nu naganay punfalinan ni ecosystem, nagana jahasi ihnah ecosystem ja jahasi nunsaba-sabali an at'atton sha hino'ha an mamangmang? Ad uwan, itoy an chapter, ja ashalon tau ni functions/a'at shi ecosystem. Inilaon tau naganay importanten ma'ma'at hi ane'ashan tau an ashi pa'atiggan ni mata tau. Jahatu functions shi ecosystem ja importante an ashalon tau ti maapektaran shi biag tau agwaagwaa/afigafigat. Shan penhod ju an inilaon nu nagana jahatu? Nu athishi, agam mo ta umuy tau hi sumarunu an topic.

Hay function ni ecosystem ja shatoy ni interaction ni components na. Shatoy interaction ja ihnay tulu an resorta na: 1) nan rate an umajan ni energy hi gway ihnay biyagna an components, 2) nan rate ni chemical umat nah phosphorus, carbon, ja nitrogen cycle ni ecosystem, an mapu ane'ashan shi miid biyagna ja imuy ashan shi ihnay biyagna ja infanggad na gu hi miid biyagna an components, 3) hay aat shi ecosystem hinan um'ummuy an timpu. Itoy an chapter ja ashalon tau ni mahhun/umuna an shugwan functional traits.



Topic 1: Flow of Energy



Mattig itoy an latlatu nu kas'anuan ni energy an umuy hi ecosystem. Shan inila ju shatoy an topic? Oha pay, shan ninomnom ju ngata nu naguy apugwan ni energy? Nagan ni energy an usaron ni alah? An shan ninomnom ju an mun'us'ussar aju hi energy? Tapnu inilaon tau jahatun topic ja sungbatan ju jahatun damag (questions). Tigan/buyaon ju ni video ta tigan ju nu nagu ni ustu an apugwan ni energy, kas'anuan an mipasa ni energy hi ecosystem ja kas'anuan an shumatong ay sha'ju.

- Hay key points an nomnomon nu kas'anu an umuy/mipasa ni energy hi ecosystem ja mahhun anam'in ni ihnay biyagna ja mahapo shay energy. Hay ustu an apugwan ni energy ja hay aghaw, an etmog jahasi producers an mangamma annun sha isuy an process ni photosynthesis.
- Jahasi herbivorous an animal an mangan ja hi intanum/plants ja mapun sisha ni energy ja nu anun shamshama jahasi carnivorous ja mi'otan ay sisha ni energy an anun shan ibfa shan animals.
- Hay maudin umajan shi energy ja jahasi shi decomposers an nangan weno nangetmog gway natoy an intanum/plants ja taraken/animals.

Hitoy an flow shi energy mipapu hi producers engganah decomposers ja mipattigna ni ojon sha an food chain/web.



Materials Cycle and Energy Flow
<https://bit.ly/3j7SVKF>

- Hay keypoints an nattig gway video an binuya ju ja mah-hun shi nunsasabali an organism ja nunsisinabali an trophic level shi neashan sha. Hay trophic level ja i-represent ni nahhun an filang ja hitoy shikababaaan ja mi'a-lemas an filang ja kangatuwan. Hay nahhun an trophic level ja hitoy shi neashan shi producers hi ecosystem an jahatu shiplants ja lumuy. Hay miadgwa an trophic level ja jahatu neptoan shi nahhun an consumers. Jahatu shi animals an mangan hi plants, umat hinan faka, gansheng, fafahhong ya kurkurappe.
- Hay mi-atlu an trophic level ja hishuy nifilangan ni miadgwan consumers. Jahatu shi animals an anun shay ibfa shan animals an iikuy ja nakapuy. Itoy shi nifilangan taun tatagu, hay sholog ni gwang-gwang, jahana iikuy an hamuti ja ootong an animal. Hay mi-apat an trophic level ja shatoy ni consumers an anun say ibfa shan animals an nifilangan ni 2nd ja 3rd an trophic level.
- Hay maudi ja hay mi-alemas an trophic level an nifilangan shi apex predators weno shi ojon tau an nahhun hi food chain. Jahashi animals an nifilang itoy ja sharks, tigers, lions, eagles ja ushum pay an ootong an animals. Jahatun predator ja maid shi ushum an animals an mangan ay shisha te shishay kafiahan an namin an animals.
- Hay decomposers shamshama ja mifilang sha an consumers mu hay pangngalan shah energy ja gway natoy an animals ja plants isunga ashi sha mifilang an predators weno herbivores.
- Nu munpangatu/munpafagtu hi trophic level ja 10% ja ammuna shi mabati an energy, kaspangarigan gway food chain shi holo', faka, tagu, ja bacteria gway 1000 units an energyn shi plants ja 100 units ja ammuna ni maalan ni faka ja 10 units gway tagu ja 1 unit ja ammuna shi maalan shi bacteria ja shin nabati an energy ja nautaw gapu atong/pudut.
- Hay food chain ja simple an linear presentation ni umajan shi energy gway ecosystem, ja hay food web shamshama ja comprised shi sho'o an representative shi taraken/animals an hay ohan taraken/animal ja fu' un oha ja ammuna an klasen ni taraken/animals an mangan ay hija. Hay umatan ni diagram ni food web ja umat inuy tagwang ni lawlawa an shoo ni nunhoho'op an linya an fuun lang oha. Itoy an food chain ja miid panighan an hay apex predators ja ihnay apugwan shi anun ni ushum an animals, ja ashi sha mattig an hay producers ja ihnay ushum an pang'ngalan sha anun sha ngem hay aghaw ja ammuna.

Tigan ju shutoy latlatu itoy babah ta tigan juy food web hi Ifugao Rice Terraces.

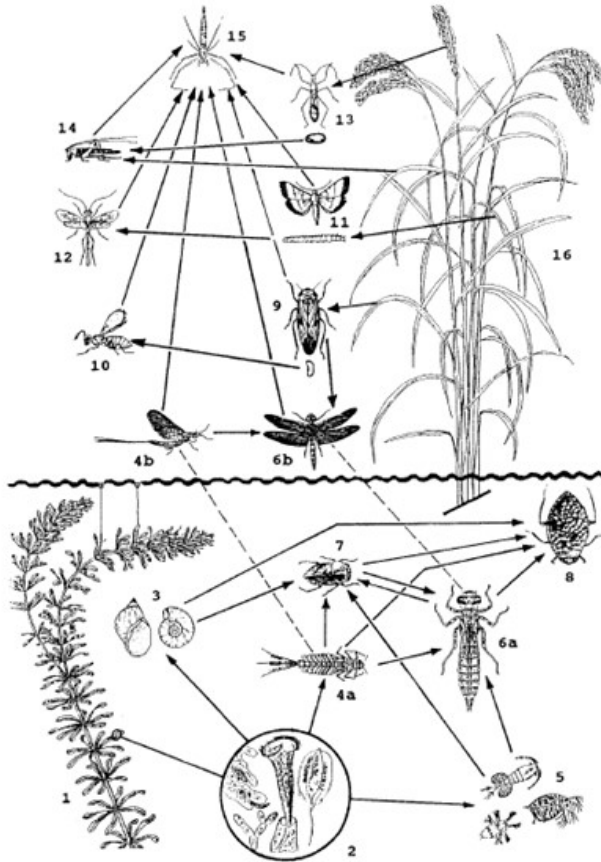


Figure 2.

Food web of an Ifugao agro-ecosystem (Setelle and Martin, 1998).

- 1 – Aquatic plant;
- 2 – algae, bacteria;
- 3 – snail;
- 4 – insect (a. larva, b. adult);
- 5 – zooplankton (microscopic floating algae);
- 6 – dragonfly (a. larva, b. adult);
- 7 – aquatic bug;
- 8 – aquatic bug;
- 9 – leafhopper;
- 10 – insect (feeds on eggs);
- 11 – leaffolder larva and adult;
- 12 – insect (feeds on larva);
- 13 – rice bug;
- 14 – grasshopper;
- 15 – spider;
- 16 – rice.

Pon’ashalan 4

Hay food chain shi nakasimpleh panighan shi umajan ni energy. Hay ohan panighan ja hay anun hi hehelong. Mahhun an nomnomon nu nagana jahasi inan. Hay meh-nod ja mangammah food chain ta mipattig nu kas’anu an shimatong ay shitau.

Pon’ashalan 5

Umimbatar ajuh gagayum ju ta aton ju ni food web an usaron jahasi nunsabasabali an ihnay biyagna hi pajaw ad Ifugao. Hino’ha ay sha’ju ja mishattan hi latlatun shi ihnay biyagna an ihna pajaw. Umuy aju munmahmah ay jahasi munpun-pajaw weno omod nu nagana mangan gway ihnan sa’ju an latlatu ja nagana mangan ay jahasi shamshama.

SELF ASSESSMENT QUESTIONS:

Piliyon ju shi letter ni ustu/immannung an sungbat.

1. Hay energy ja ihna hi pajaw gapu hi?
 - a. Producers
 - b. Consumers
 - c. Herbivores
 - d. Decomposers
2. Nan grupun shi nunhoho'op an food chain ja ma'ali an:
 - a. Pyramid of energy
 - b. Complex food chain
 - c. Food web
 - d. Food cycle
3. Hi gway ecosystem, ni energy ja mi-akar mapu hi ohan organisms ja imuy hi usum an organism, hi ngantoy an energy?
 - a. Electrical
 - b. Mechanical
 - c. Chemical
 - d. Solar
4. Shan katnay magah an solar energy hi tutufun shi ajiw hi alah nu mi'convert hi chemical energy gapu photosynthesis?
 - a. 1%
 - b. 10%
 - c. 30%
 - d. 50%
5. Nan mi-atlu an consumers gway maudi an level shi food web ja?
 - a. Agpaysu
 - b. Asi agpaysu

Topic 2: Flow of Matter

Fuun ja amuna ni energy an umuy hi ecosystem. Shan ihnay inila ju usum? Nu miid tigan ju ni video ta inilaon ju.

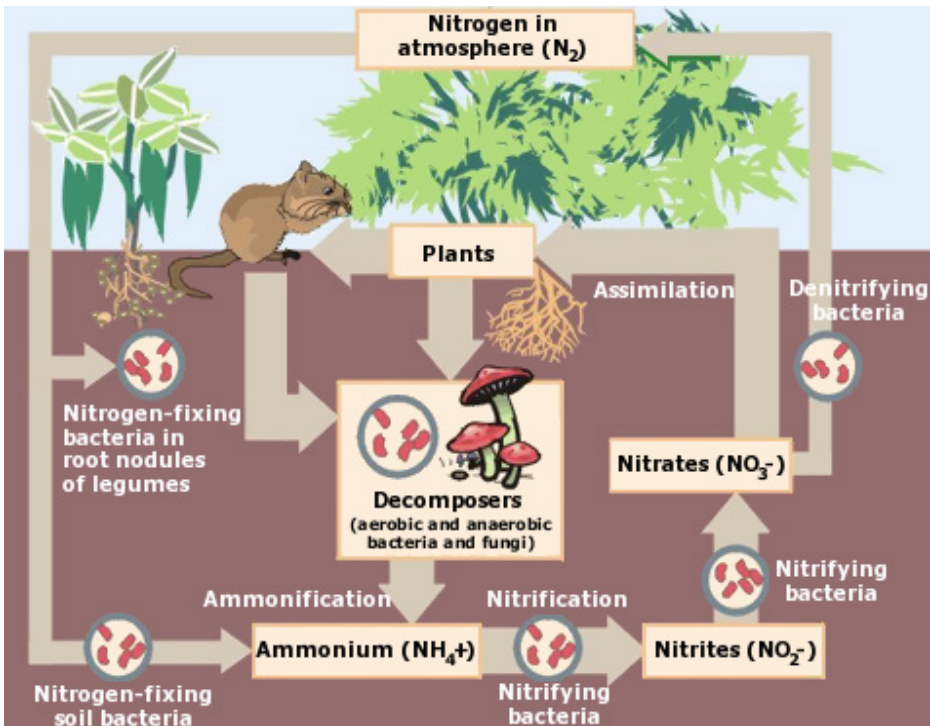
Flow of Matter and Energy through Ecosystems
<https://bit.ly/3IPeIZw>



Itoy an video ja mipattig lang ni general overview jahasi nutrient cycle. Ahi tau ashalon anam'in shi mipanggep itoy cycles an mehnod, mun-quiz tau nian ta mattig nu ihnay inashal ju:

1. Oha'ohhaon an ifaga jahasi nutrients an nifaga gway video:
2. Nagana shi process an punfalinan hinuy water vapor hi fonot/clouds?
3. Nagana pangusaran shi intanum/plants hi energy an mapu aghaw?

I. NITROGEN CYCLE



Nitrogen cycle [digital image]. Photo by US Environmental Agency (2003).

Retrieved from https://upload.wikimedia.org/wikipedia/commons/f/fe/Nitrogen_Cycle.svg

Itoy an section, ja ihna pay shi ushum an ashalon tau mipanggep hi nitrogen cycle. Ja hay kinaimportante na hi biyag tau agwaagwaa/afigafigat. Tigan hishuy an latlatun shi diagram shi nitrogen cycle.

Nitrogen Cycle

<https://bit.ly/3huW1Z2>

I-discuss tau jahasi importante an manomnom tau mipanggep hi nitrogen cycle. Mahhun ja importante shi nitrogen hi anam'in an ihnay biyagna te mahapo hi pangipa-ihnaahan shi DNA, RNA ja protein.

78% han angin hi atmosphere gapuh hi Nitrogen. Manu ti sho-shoo shi atmospheric gasses ja nitrogen mu asi diretso an usaron jahasi ihnay biyagna shi nitrogen hinan gaseous form. Hay nitrogenous compound an na-ihna gapuh nitrogen cycle ja jahasi mausar ni ihnay biyagna. Ja shi leman umatan shi nitrogen cycle jahaton jahasi micro-organism.

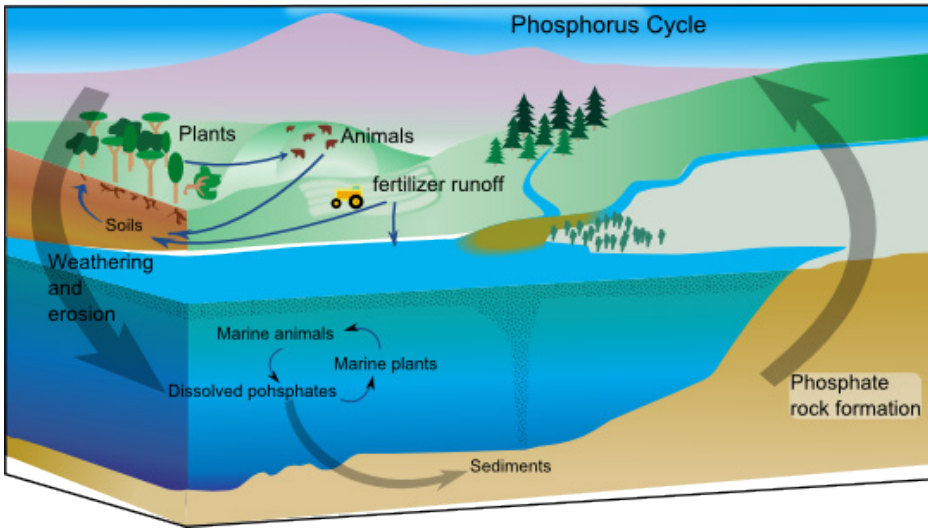
Jahasi luta an miid shi nitrogenous compounds ja usaron shi industries shi nitrogen – based fertilizers ta shumshumoo shi nitrogenous compound gway luta. Mu nu adja inpahig shi usar ay jahatun abono ja ashí maphod ni punfalinana ti maihnay ojon sa an environmental hazard, an munfalin sha ojon sha an acidic ta maloghet mo ni shanum ja ihnay madi an maat hi fimmobloy.

SELF ASSESSMENT QUESTIONS:

Sungbatan ju nan damag an mipanggep hi Nitrogen Cycle.

- Ngashan jahasi kinanayun an kaatan shi nitrogen cycle?
 - Kilat (lightning)
 - Fossil fuel combustion
 - Nitrogen fixing bacteria
 - A puy gway inalahan (forest fires)
- Nitrogenous waste compound nan nun'aatoy an intanum/plants ja ta'in shi taraken/animals ja mifangngad hi nitrogenous compound an umat hi ammonium an umuy hi proseson ni _____?
 - Nitrogen fixation
 - Nitrification
 - Decay
 - Maid gway punpilijan
- Naganay proseson shi munpahagwang hi nitrogen gas pafangngad shi atmosphere?
 - Denitrification
 - Nitrogen fixation
 - Decay
 - Nitrification
- Once bacteria have fixed nitrogen, ja mafalin an alan shi intanum/plants ja taraken/animals an usaron shan mun-produce hi _____.
 - Nitrogen oxides
 - Carbohydrates
 - Proteins
 - Energy
- Synthetic fertilizers ja idshum nay _____ gway luta:
 - Organic nitrogen
 - Fixed nitrogen (ammonium)
 - Nitrogen oxides
 - Rhizobium bacteria

II. PHOSPHORUS CYCLE



Phosphorus cycle [digital image].

Photo retrieved from https://upload.wikimedia.org/wikipedia/commons/5/56/Phosphorus_cycle.png.

Hay mehnod an nutrients cycle ja hitoy shi ojon tau an phosphorus cycle. Hishuy an latlatu (image) shi panighan hi general overview hitoy an cycle. Tigan tau toy video ta ashalon tauy umatana.

Phosphorus Cycle

<https://bit.ly/2CR3pyy>

Tigan tau shi keypoints mipangep hi Phosphorus Cycle.

- Hay Phosphorous Cycle ja importante an nutrient hi tumaghuwan jahasi ihnay biyagna. Manu aja an mahapo ni ihnay biyagna shi Phosphorus ta ihnay ATP an hishuy shi mahapo ta midshum shi DNA ja RNA ja usum an critical compounds an mahapo ta nanongnan matagu jahasi ihnay biyagna. Hay Phosphorus cycle ja mahapo an ihnay maat an cycle ta ahi umuy gway sabasabali an reservoir hitu luta, ja gway ihnay biyagna ja ma'ma'at shi shoo an chemical reactions ja malumman shi aat shi umatan shuy an cycle. Mu hay Phosphorus Cycle ja miid significant gaseous phase na.
- Uray an naka'importantey phosphorous ja mahapo an nomnomon an ashi abusuwon/pahhigan shi pun'usar hi phosphate an abono ja ashi nogom shi pang-paajan hi naabonoan an shanum ti gumapuh apa-ehan shi ecology.

SELF ASSESSMENT QUESTIONS:

1. Naganay apugwan shi Phosphorus?

a. Atmosphere	c. Fatu (rocks)
b. Shanum/liting (water)	d. Ushan (rain)

2. Hay tatagu ja makaala sha hi phosphorus.

a. Agpaysu	b. Asi agpaysu
------------	----------------

3. Ngashan shuy parten shi intanum/plants an mun'absorb hi phosphorus?

a. Tufu (leaves)	c. Asho/haping (stem)
b. Hafung (flowers)	d. Ramut (roots)

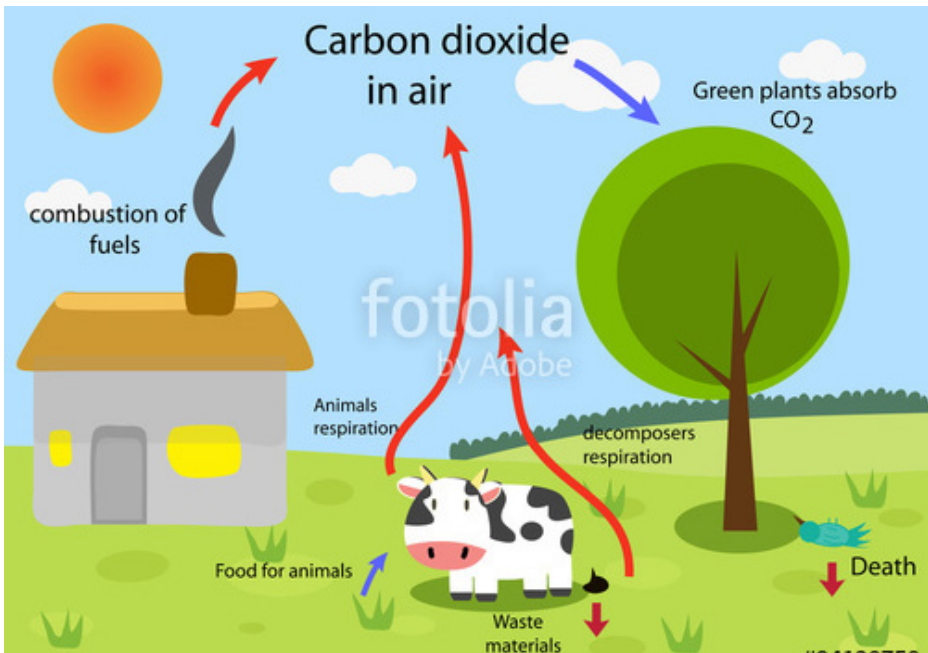
4. Shan ma'aphod an shooshoo ni phosphorus an mahapo ni ecosystem?

a. Agpaysu	b. Asi agpaysu
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5. Naganay pun'ali ni jahasi subra an nutrients an nattig gway gwanggwang an rason shi oxygen depletion?

a. Nutrient Pollution	c. Oxygen degradation
b. Eutrophication	d. Ephemeralization

III. CARBON CYCLE



The carbon cycle [digital image]. Photo retrieved from <https://co.fotolia.com/id/94128758>.

Carbon Cycle
<https://bit.ly/31o4SGg>

Hay maudi an idiscuss tau ja mipanggep hi carbon cycle. Hisuy an latlatu ja ipattig na shi general overview shi Carbon Cycle. Tigan/buyaon hishuy an video ta nad'uman pay shi inilaon mipanggep ay shatoy an carbon cycle.

- Hay key points an nomnomon tau mipanggep hi carbon cycle ja mahhun, hay carbon ja mahapo shi ihnay biyagna ta ihnay aton san matagu. Anam'in ni ihnay carbon na ja maali an organic molecules ja hay miid di carbon na ja ojon tau an inorganic molecules.
- Hay ustu an mangusar hi sho'shool an carbon molecules an gway shibshib ja jahasi intanum/plants ja ushum an producers. Usaron shay carbon hi photosynthesis, ta gway umatana an maamma ni glucose, an mipasa samsama hi consumers, ja hay maudi ja jahasi decomposers.
- Hay animals ja makaala sha hi carbon gapu gway panganan sa hi tutufu (herbivores), ngem hay usum an umat hayapex predators ja maala sa nah panganan sa hi tanom weno hay padshong shan animals (carnivores). Mangihagwang metlang shianimals hi carbon gway shibshib/angin an hisuy shicarbon dioxide.
- Jahasi decomposers ja shisay umuy weno mihaad gway nun-aatoyan tanom, animal, ja nan usum. Jahasi guy munhagwang hi carbon an nihaad gway nun-aatoy an animal weno tutufu, an mifanggad metlang gway atmosphere an carbon dioxide ja hinan luta an carbon compound.
- Jahasi consumers ja ipa-ukat say carbon an mapo asho sha through the process of respiration. Nu ashi ju pay inila, hay carbon ja mifaga an hitoy ja greenhouse gas gapuh kabaelanan an mun-contain/to hold heat. Ya gapuh pangat shitagu, an jahasi nahamad an mun'apektar hi concentration shicarbon hi atmosphere ja ihna moy global warming. Hay gapun toy numpay ja hay namahig an concentration di carbon hi atmosphere an hay ustu an gumapu ja nan mun'ohob an fossil ja sho-o-sho-o an livestock shi agriculture ja hay ushum pay an ato-aton ni tagu.

SELF ASSESSMENT QUESTIONS:

Agpysu ja Asi Agpaysu:

1. Hay carbon ja maali an green gases gapu ta tumulung shah nan umotongan shiintanum/plantsa.
2. Hay carbon ja maka-trap hi atong/pudut an mapo gway potang?
3. Hay carbon gas shi mi'adgwa gway shilag ni potang/algo ja han kaimportante'anan munproduce ni maan?
4. Hay inorganic molecules ja jahasi nan compounds an ihnay/gashay carbon molecules na?
5. Hay intanum/plants ja mun'aborb/mangetmog jah carbon dioxide nu timpun shi photosynthesis?

Inashal tau moy mipanggep hi energy flow ja biogeochemical cycles. Usaron tau shasuy an baru an inashal tau an mangat ay shatoy!

Pon'ashalan 6

Pumili oha gway energy flow, nitrogen cycle, phosphorous cycle, ja carbon cycle. Mahapo an inilaon/i-identify ju jahasi o'ohan key components gway pinili jun topic an ihnah nunfoblojan ju, ja i-illustrate/pattig ju ja i-discuss ju ni pinili jun topic an usaron jahasi components. Mahapo an ihnay nikamangana ni pinili jun topic, umat kuma hi kinakurang ni nitrogen hi luta ta humlun/gumapu an ihnay famine; namahig/napahhig an pun'usar hi phosphorus an abonoh ja nun-aatoy shay sholog gway peh'ong, gwanggwang.

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CHAPTER 3: ECOLOGICAL SUCCESSION

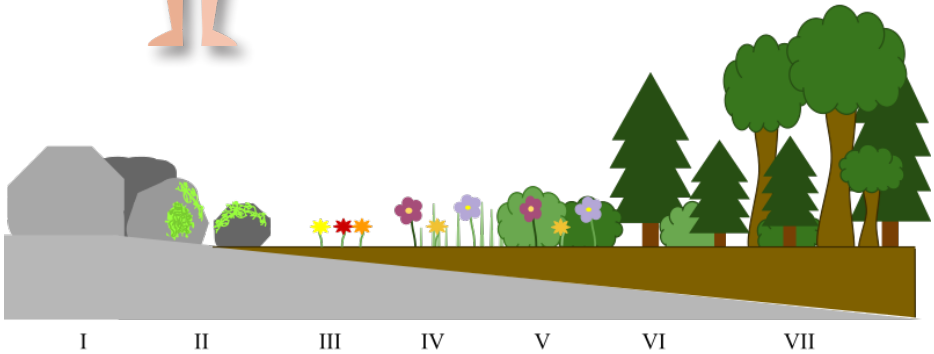


Hi agibfowan toy an chapter ja mafalin mo an:

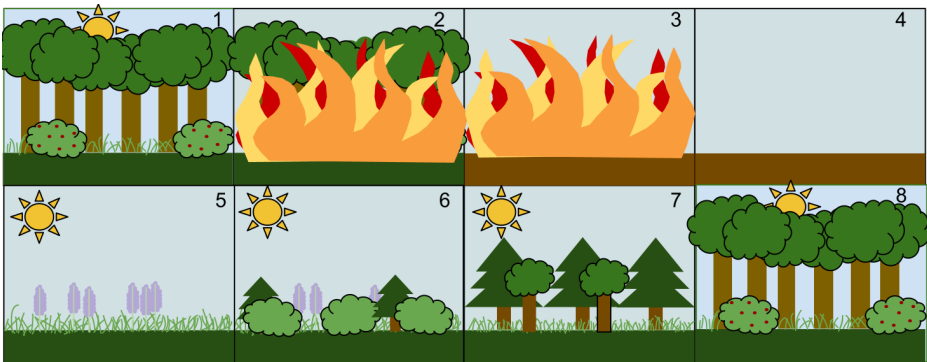
1. Ojon shi shugwa an sabasabali an klasen ecological succession;
2. Ojon shi sucession ni sabasabali an klassenn intanum/plants gway oha an lugar;
3. Maihnay punbalor/value hi kinaimportanten ni ecological/ ecosystem succession an miapply hi management di IRT.



Shan inila ju nu naganay ecological succession? Tigan ju jahasi latlatu (picture) hina ompana:

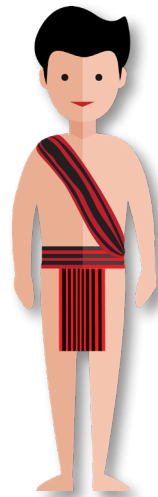


Primary ecological succession [digital image].
Photo retrieved from https://upload.wikimedia.org/wikipedia/commons/4/4d/Primary_Succession_Diagram.svg



Secondary ecological succession [digital image]. Photo by Katelyn Murphy. (2012, May 19).
Retrieved from https://upload.wikimedia.org/wikipedia/commons/4/47/Secondary_Succession.png

Mattig ay jahasi latlatu shi shugwan klasen shi ecological succession. Mu nagana ni penhod nan ifaga ni ecological succession? Hay simple an penhod nan ifaga ja, hay ecological succession ja hitoy shi pumbalibaliwan ni composition jahasi species (weno nunsabasabali an intanum/plants ja taraken/animals) hi ohan lugar hi napinto' an timpu. Importante shi ecological succession ti maihnay regeneration shi ecosystem weno nan ushumna nu nagibfo nan nunbaliwana nunbnuushum ja ammuna.



Itoy an chapter ja mangmangon/obserbaron tau ni process ni ecological succession hi intanum/plants.

Pun’adalan 7

Tigan toy video hi ecological succession.



Ecological Succession
<https://bit.ly/2QnkBic>

Siguraduwon an ashalon ni nunsabasabalian ni primary ja secondary succession. Shan mafalin an ojon ju nu nagana jasashi?

<i>Mahun an Succession</i>	<i>Mi’adgwa an Succession</i>

1. Umuy aju munshalshallanan hi nunfoblajan ju. Hay aton ju ja tigan ju ni ohan lugar hi inuman an umat nan nagafutan ja nakinkinan hi napalabas an tulun linggugwan. Latlatuwon ju jahasi, i-focus ju jahasi ni lugar pati nunsabasabali an himmangaw an holo/intanum (plants species) jahasi. Nu nala’oh aja guy shugwa o tulun linggugwan, ja ummuy ju gu linatlatu ja inlista ju ni inobserbar ju an holo/intanum. Aton ju guh toy nu malaoh ni shugwa o tulun linggugwan ja intusho’ ju ni minangmang/naobserbar ju.

<i>Week of observation</i>	<i>Plants observed (common name)</i>
<i>0-2 weeks</i>	
<i>After 2-3 weeks</i>	
<i>After another 2-3 weeks</i>	

2. Gway tinnig juh video, hay finaha ju internet ja libruh libraries, nganay umali nomnom ju hinan kaimportanten ni ecological succession an aton shi ecosystem?

3. Hay inila ju, naawatan ju, kas'anu ni ecological succession ja maat hi IRT landscape. I-explain ju.

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CHAPTER 4: ECOSYSTEM SERVICES



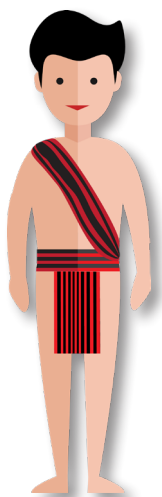
Nu magibfoh toy an ashalon/chapter ja mafalin kuma mo an:

1. Ojon shi key services shi ecosystem an ihnay/gashay nikamangana hi ifugao Rice terraces landscape;
2. Ojon shi nunsabasabali an maala an maphod ishuy categories an nafilangan sha.

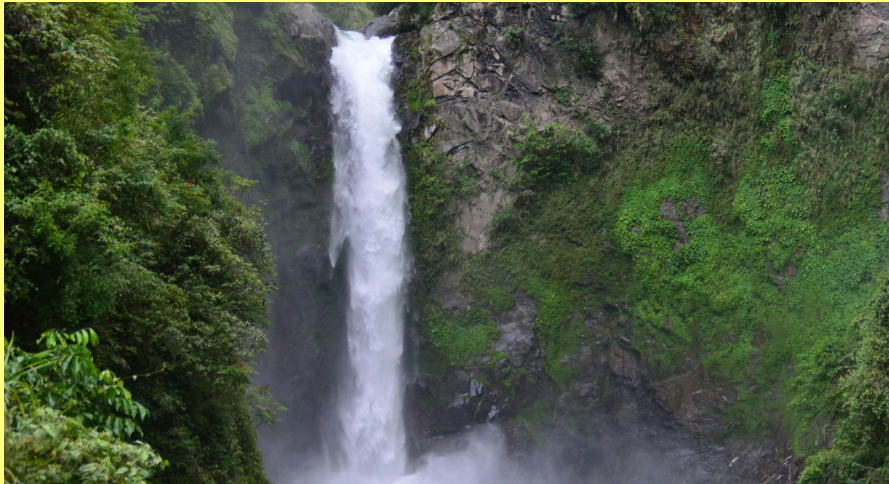
Inashal tau moy mipanggep hi ecosystem ja jahasi components ja naganay functions sha, nagana shatoy an naporma an engganad ugwan ja nanongnan ihna. Ad uwan, itoy an chapter ja ashalon tauy mipanggep hi maala tau hi ecosystem, an sapay kuma ta nomnomon tauy kinaimpoatanten jahasi ecosystem.



Inilaon tau jahasi an maali an “ecosystem services”, an maala jahasi maala tau hi ecosystem. Tulu ni importanten ma’at na: direct services, indirect services ya aesthetic/ethical effects.



Tigan ni video ta ahi tau umuy ishuy topic an ecosystem services.



Ecosystem Services
<https://bit.ly/3ldoYL4>

Hitoy an video ja general overview shi od'ojon tau, Ashi tau maifagan namin. Ngem mahapo an ihaad tau nomnom tau:

- Ilnay tulun rason nu naguni' ta importantey biodiversity shi ecosystem; Jahatu shi: 1) direct services, 2) indirect services, ya 3) aesthetic/ethical effects;
- Direct services ja shatoy jahasi maala gapu hi pakiinteraction tau hi ecosystem services, umat nan maala tauh maan, hay peh'ashan, materials, aga, ja ushum pay;
- Indirect services ja sasuy maala tau an ashi mahapo an makiineteract taku hi ecosystem. Umat hi (nu nih'up tauh baybay) ja maprotectaran tau hi dalluyun, shum'ol shisholog hi baybay nu ihna say mangroves hi pengnget shibaybay, ihna y malene an shanum ti nu enetmog ni luta ja nasagat ni log'et gway shanum, ja ihna pay ni ushum;
- Aesthetic/ethical effects ja sasuy jahasi mipafoltan ay sasuy sumarunu an holag, ja ushum pay an maala taun maphod hi ecosystem, umat hi lengshop shinomnom nu hen'ussum umuy tau munoh'ohha ni alah, hay ragsak nu tighan tau ni napintas an limmun Ma'nongan (nature), ja ushum pay;v ja
- Direct services, jahatu ni nalaka taun faloron ti jahatu ja materials. Mu ihna shamsamay balor shi indirect services ja aesthetic/ethical effects mu miid shi mapto' hi pumfalor. Mu hay importanten satoy ja punnanongon weno ephod pay shi ecosystem ja ecosystem biodiversity hi numfoblojon tau.

Pun’adalan 8

Ojon tauy abalinan toy ecosystem services. Piliyon shi ohan i-discuss nu direct services, indirect services weno aesthetic/ethical effects. Nu nagibfo ja, ojon jahasi maphod an maala hi Ifugao Rice Terraces an nifilang gway pinili jun topic. Ja ojon ju naguni’ta nomnomon ju an importante ay sa’ju ni maala hi IRT.

SELF ASSESSMENT QUESTIONS:

Itusho’ ju nu naganay maala tau hi papajaw taun immipugo.

<i>Direct Services</i>	<i>Indirect Services</i>	<i>Aesthetic/Ethical Effects</i>

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CHAPTER 5: IMPACTS OF HUMAN ACTIVITIES ON ECOSYSTEM SERVICES



Nu malpas hitoy an chapter ja mafalin mo an:

1. Ojon asha'lan ni ma'ma'at ni tatagu hi IRT ja nagana ni epektona jahasi nunsabasabali an ecosystem gway landscape;
2. Mi-expalin nu kasanu an naapektaran shi ecological functions/ processes ja hay nahpay ni ecosystem.

Hay ma'ma'at an pun'ephoshan ja mangshat hi mayat ja madi an maat hi environment / jahasi mattig an ma'ma'at, umat hinan Agricultural Production ja ushum an economic activities, alah/ forest management ja conservation, mass ecotourism ja hitoy urbanization an midshum pay hi shuma'alan shi tatagu an mangsat pay hi ustu an ma'at tapnu munnanong shi papajaw shi Immipugo.



Hay ushum an umatan shi nakiloh an epekto ja, umat ini umatungan shi aalah ja hay apa'egan shi luluta gapu ni punli'ojan ini aajiw ja hay umikkujan ni biodiversity (kinaihhan shi nunsabasabali an klaseh shi tanum ja taraken/ animals ini ngilig) gapu ni (shimoolan nin nunduduma an mephod) urbanization. Ihna shamshamay maphod an epekton shi aat shi tatagu, jahatu ni pangipapto' hi alah umat ini puntanuman hi aajiw ta masukatan shi dati ja hinuy nun'aatoy an ajiw. ja hay oha pay ni prafit shi tourism an umuy hi pangipapto' hi alah hinan nunfoblojan.



Pun’adalan 9

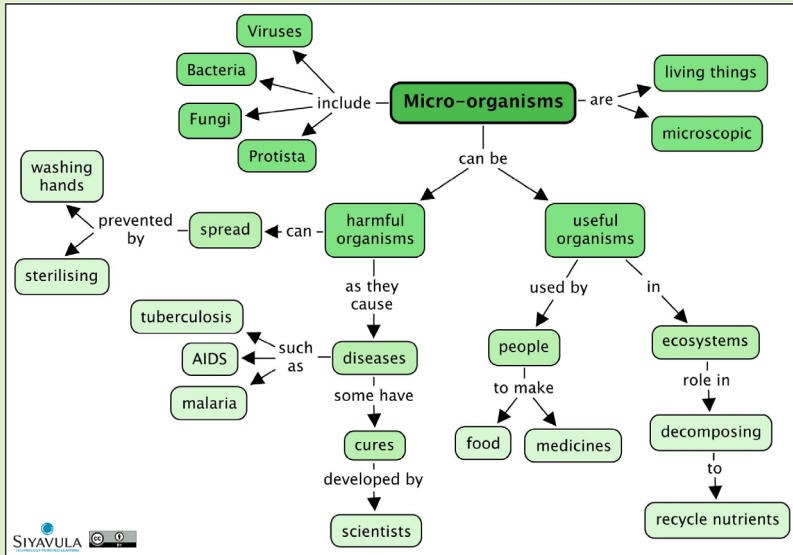
1. Naganasan ajun munfidfid jahasi ihnah internet, newspapers ja ushum pay an mipanggep hi “Contemporary Developments Problems in Ifugao Rice Terraces.”Oha pay ja tigan ju gway linatlatu ju weno mangipattig ajuh latlatu an maipattig ni issues ja probleman shi IRT ta midshum an pun’ashalan ju.

Munmahmah aju gway pamilya ju hay gagayyum ju hi mipanggep ay satoy an topic. Idiscuss ju ay sisha ta inilaon juy punnomnom sha, ja hay punnomnom ju shamsama. Ibasar juh nuy discussion ju shi itusho’ ju tun table:

<i>Activity</i>	<i>Main ecosystem affected</i>	<i>Issue/ Problem</i>	<i>Ecosystem service affected</i>	<i>Effect (+, -, or neutral)</i>
<i>Ex.: conversion into vegetable gardens</i>	<i>payoh</i>	<i>Decreased area for traditional rice production</i>	<i>Provisioning function: decreased native rice production</i>	<i>(-)</i>

Pa’anomnomon tau an hitoy an ashalon tau ja mangshat hi maphod ja madi an maat hi aglawlaw/environment. Hitoy ojon sha an ‘trade-off’. Mafalin an i-discuss ju nu ngay decision an maala itoy an information.

2. Tapnu mattig an agpaysu an naawatan ju jahatu issues ja problema ja epekto sha ni ecosystem services, mangephod aju hi conceptual map an mipattig ni nikamangan jahasi nunsabasabali an idea ju. Athitu, hay conceptual map ja diagram /illustration jahasi ideas (key points on words) an ihnay boxes, an mipattig nunkakamangan sha an mipattig hi arrow/pana. Hitoy ni example/ pangiuun'unushan.



Conceptual map [digital image]. Photo by Siyavula Education. (2014, March 31). Retrieved from Flickr.



Shan nalpas ju ni at'atton
ju? Shan hi punnomnom ju ja
ihnay inashal ju? Sapay kumat
ginanganas juh toy an Book ja
sapay kuma ta usaron/i'at juh
nuy inashal ju hi agwa-agwaa/
afigafigat. Hitoy pogpognah
toy an book, ta ahi gu ni
mitun'ud ni ushum.

ANSWER KEYS

Chapter 1

Topic 1 Learning Activity 2

1. living and nonliving, environment
2. Producers, decomposers

Topic 2 Learning Activity 3

Type of interaction	Organism 1	Organism 2
<i>Predation</i>	+	-
<i>Herbivory</i>	+	-
<i>Competition</i>	-	-
<i>Mutualism</i>	+	+
<i>Parasitism</i>	+	-
<i>Commensalism</i>	+	+

Chapter 2

Topic 1 Learning Activity 5

1. d
2. c
3. a
4. b
5. a

Nitrogen Cycle

1. d
2. a
3. b
4. d
5. a

Phosphorus Cycle

1. c
2. b
3. d
4. b
5. b

Carbon Cycle

1. b
2. a
3. a
4. b
5. a

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