



In India Ladakh is a climatic and technological minority as well.

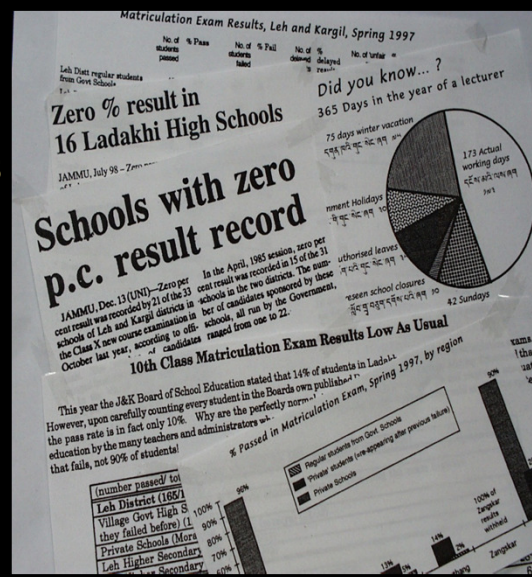


Challenges of development...



During 1970s and 80s...

95% of Ladakhi students used to fail in matric exams



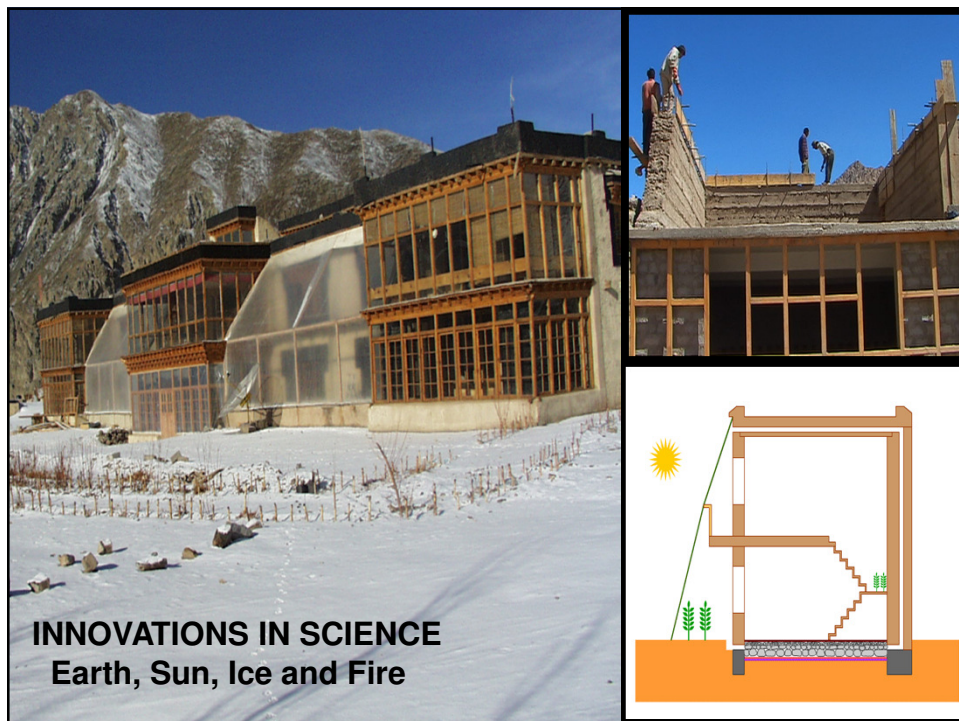
Changing Matric Results

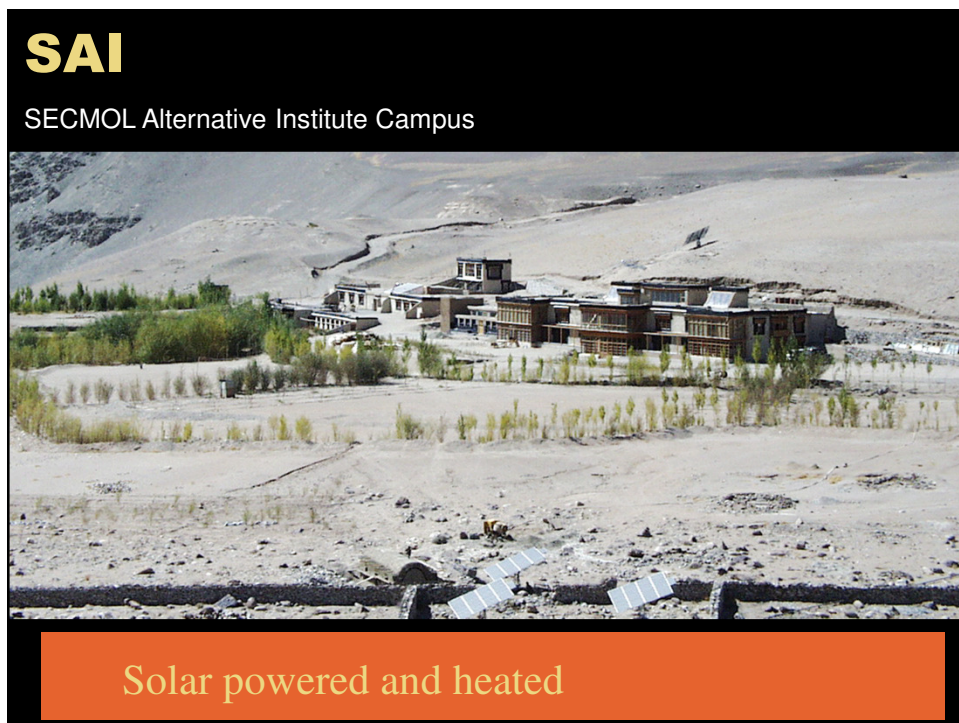
Year	Matric results %
1996	5
1997	5
1998	5
1999	7
2000	23
2001	36
2002	35
2003	49
2013	72











South orientation to collect solar heat



The architecture is a pleasant blend of tradition and modernity



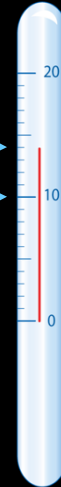


Inside temperature in winter

- Average evening temperature
- Minimum in a normal winter

+ 16 °C

+ 10 °C



- And naturally cool in summer



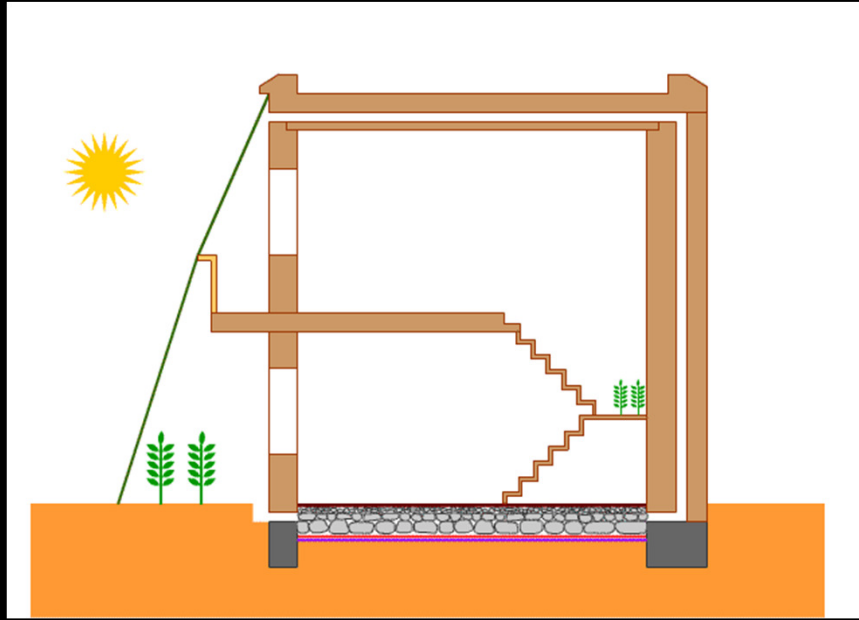
Flowers bloom even in January when the minimum temperature outside is – 25 °C.

Natural lighting:

Windows and skylights are kept in a way that no place in the building needs electric lights during the day.



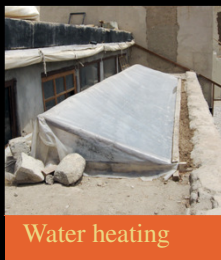
Attached Greenhouse concept



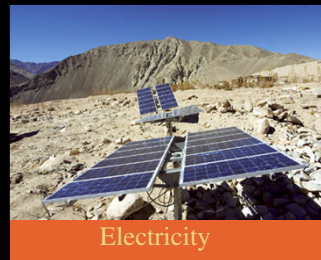
We also use solar energy for:



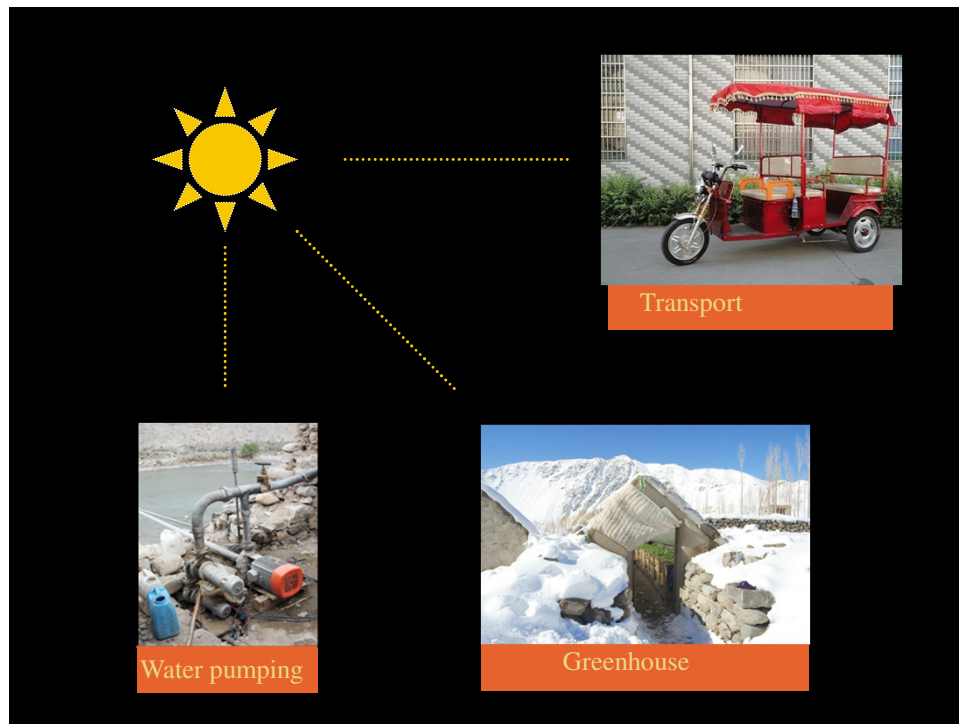
Cooking



Water heating



Electricity



solar cowshed

Woodless mud-vault

The temperature stays at an average +12 C and...

as a reward, the cows give more milk since the energy from the food does not have to go for heating their huge bodies.



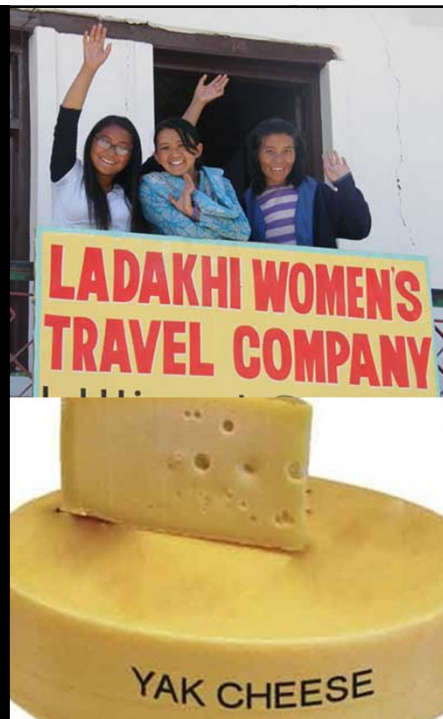




Our way is to find solutions to
Ladakh's challenges,
and then

**Launch
young entrepreneurs to
deliver them**

Few of the
enterprises



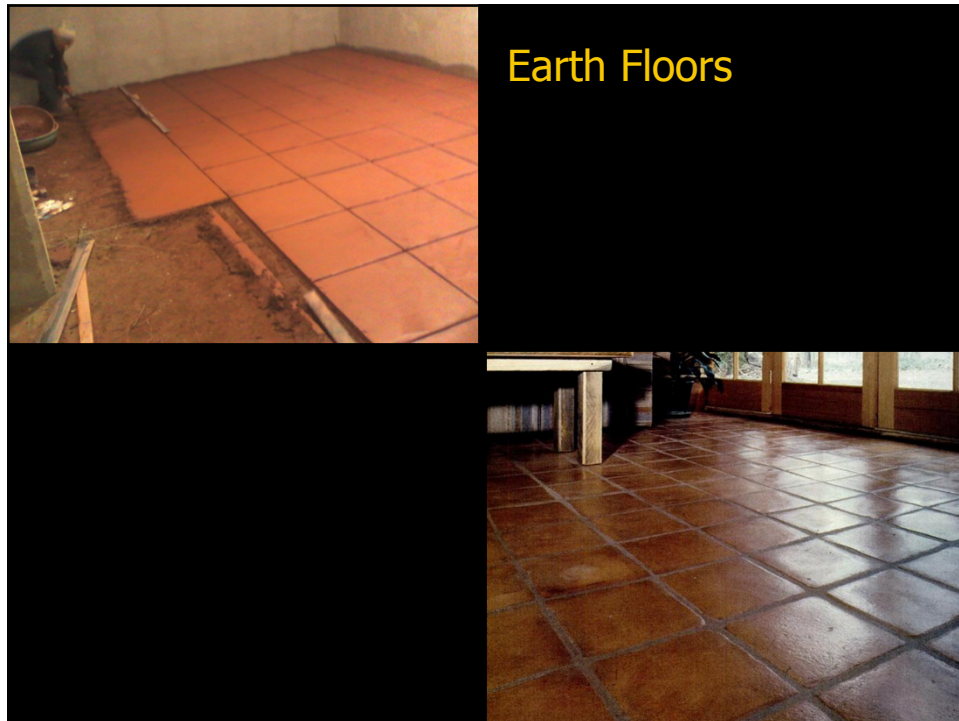
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◆ Green Thumbs
Commercial Low Cost
Greenhouses Company









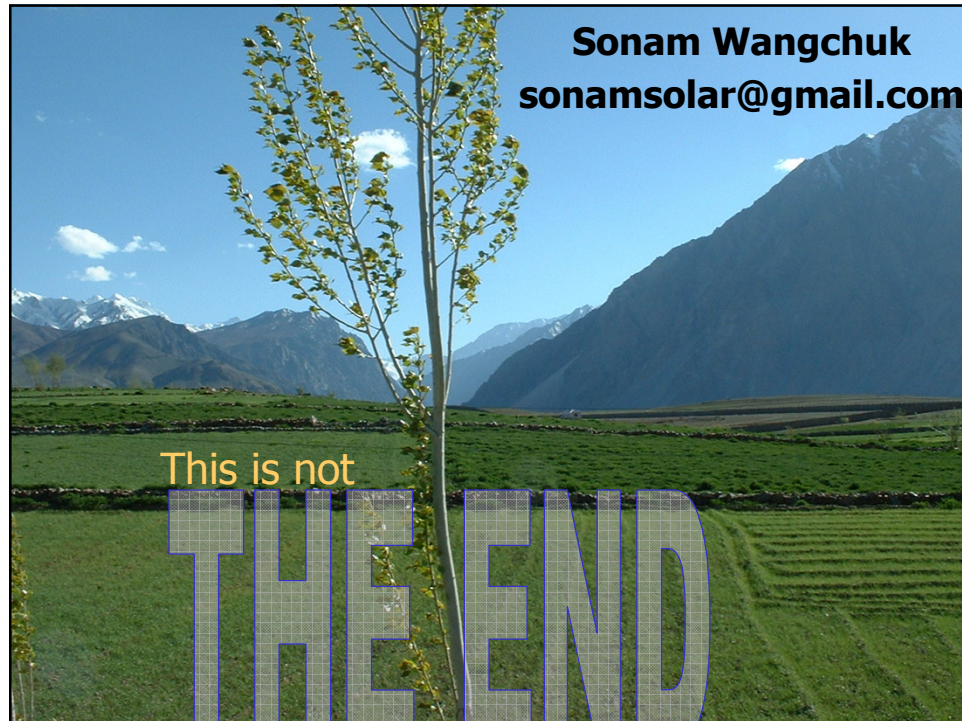
Sharing the Experience:

International Courses in Passive Solar and Earth Architecture



Collaboration with MIT, USA
MASDAR Institute, UAE
CRATerre, France







Challenge of Sandy Soils 2

INNOVATIONS

Freeze thaw technique to pulverise the pure clays.

As mentioned in the previous section, the clay slip method has some limitations, such as it make the mixing very difficult and it limits the mixing proportion to a maximum of 8% clay. The other method normally used is pulverisation and it is an earth builders nightmare in terms of human labour and energy costs if done mechanically.

But in Ladakh and other cold countries we have a blessing. I observed that the same natural causes that makes rocks to become soil or turn good walls and plasters into dust, could for once... be put to our use.

The process is called freeze thaw when water seeps into the cracks of rocks or walls it freezes at night and expands... breaking the solid structure around then in the day it thaws and seeps even deeper and the cycle is repeated.

During the winter I wet the hard claystones several times and then nature takes care of the rest. By spring one gets a soft dry dust of clay ready to mix in the sandy soils in the proportion one desires. I propose to do this at a significant scale so that pure clay could be sold in bags just like cement bags. For soil stabilisation people could either buy portland



INNOVATIONS **Low Cost Pan Mixer**

Most rammed earth builders a common complaint, that ordinary concrete mixers don't work for mixing soil for rammed earth or compressed earth blocks. The soil rolls into lots of balls as the mixer bucket rotates horizontal axis. This is especially serious when mixing cement to stabilise the soil as the cement gets concentrated in balls and prevents uniform distribution.

The big advantage of a concrete mixer is that they are mass-produced and are available every where at affordable prices. Where as planetary mixers which are recommended for soil mixing are very rare and an expensive piece of equipment.

In keeping with the true Indian spirit of low-cost adaptations called 'Jugaad' we successfully modified two second-hand concrete mixers into wonderfully functional soil mixers. It cost us just Euro 75 extra to do that. Normally in India it costs roughly Eu. 1,000 for a concrete mixer and Eu. 3,000 for a pan mixer.

Replaces: Remove the conical part of the concrete mixer and place metal arms that rest

Makes clay balls ... bad for the mix

10/06/2013 18:1

45

INNOVATIONS **Wheelbarrow on rails**

Among the various machines used and tested, this simple machine i.e. inclined plane proves to be the most efficient. Use of wheel barrows on planks was a good improvement in efficiency but it was risky, because for portability the planks had to be thin. This made it unwieldy for the worker when a loaded barrow had to climb a meter high in order to reach the pan mixer.

Therefore we developed this rail system which ensured that the two wheels always remain on track and reaches the right spot at the mixer top irrespective of the skills of the worker. Apart from climbs it is also good for the flat surfaces as it gives a clean and dirt free track. We have some times used this system to move soil from up to 14 meters away by joining four rails of 3.5 m each. The best part is that if needed, the rails can become regular ladders. We are working to make a similar system from the mixer to the top of the formwork in order to replace the powered conveyor belt.

Replaces: 2 workers

46

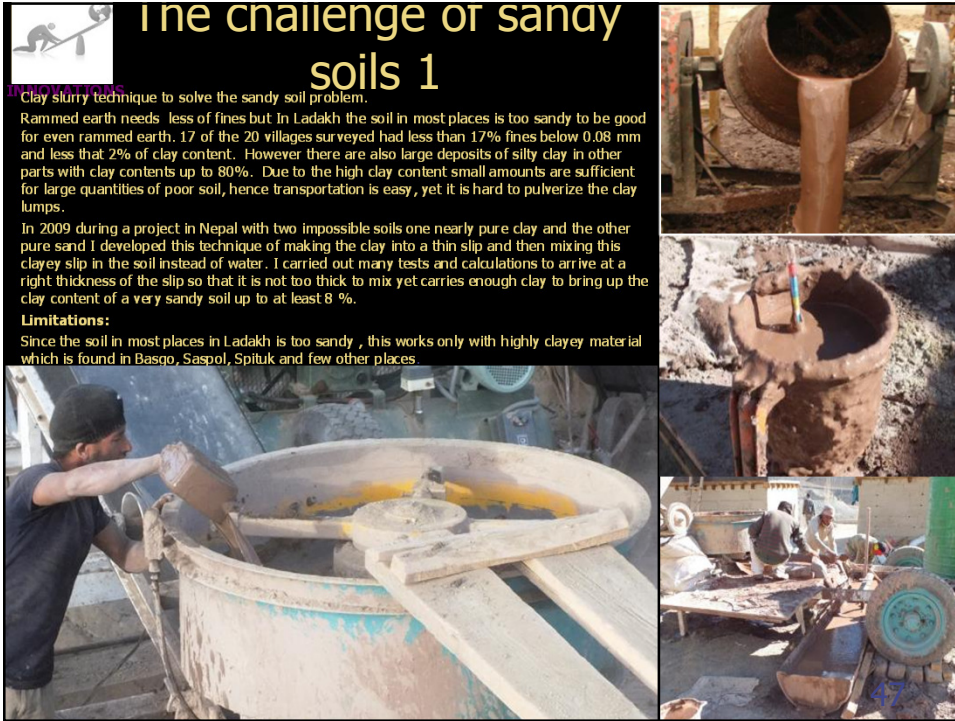
The challenge of sandy soils 1

Clay slurry technique to solve the sandy soil problem.

Rammed earth needs less of fines but in Ladakh the soil in most places is too sandy to be good for even rammed earth. 17 of the 20 villages surveyed had less than 17% fines below 0.08 mm and less than 2% of clay content. However there are also large deposits of silty clay in other parts with clay contents up to 80%. Due to the high clay content small amounts are sufficient for large quantities of poor soil, hence transportation is easy, yet it is hard to pulverize the clay lumps.

In 2009 during a project in Nepal with two impossible soils one nearly pure clay and the other pure sand I developed this technique of making the clay into a thin slip and then mixing this clayey slip in the soil instead of water. I carried out many tests and calculations to arrive at a right thickness of the slip so that it is not too thick to mix yet carries enough clay to bring up the clay content of a very sandy soil up to at least 8%.

Limitations:
Since the soil in most places in Ladakh is too sandy, this works only with highly clayey material which is found in Basgo, Saspol, Spituk and few other places.



Rammed Earth



Mounting



Dismounting

48



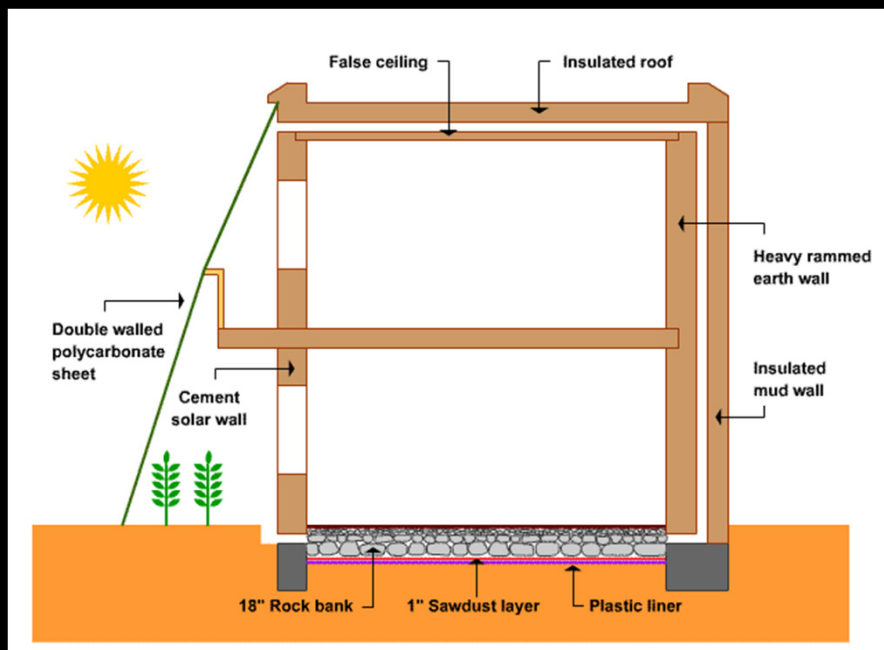
Woodless
mud-vault
house



Challenges of development...



And for long term heat storage





Bright
Head

Skilled
Hands

Kind
Heart



Village Mobilization Campaigns by Students







◆ Bringing alive the past



Environmental Studies

