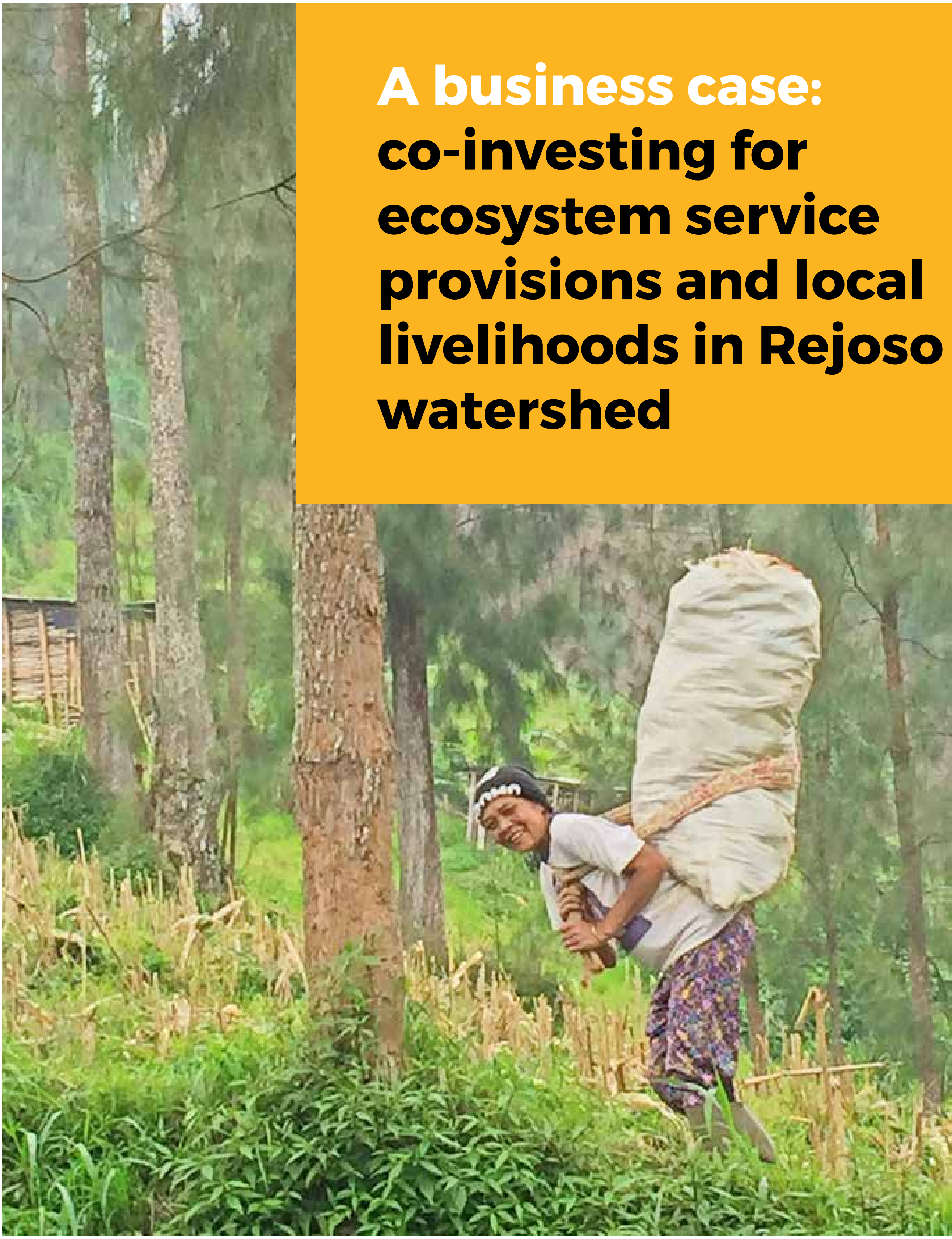
# A business case: co-investing for ecosystem service provisions and local livelihoods in Rejoso watershed



WORLD AGROFORESTRY CENTRE

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**Language editor:** Robert Finlayson

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# 01 Executive summary

(Left–right) Monitoring infiltration at farming land. Photo: University of Brawijaya; Corporate social responsibility activity. Photo: AQUA Danone; Rich volcanic soil nurturing horticulure farms. Photo: World Agroforestry Centre/Ni'matul Khasanah.

The Rejoso business case is based on information from piloting a payment for ecosystem services (PES) scheme aimed at stimulating multi-stakeholder co-investment in restoring and maintaining good watershed functions. The business case presents the benefits of applying innovations in setting the PES pilot that enhance participation and inclusiveness of smallholder farmers in the programme, link the scientific approaches to on-the-ground actions and, ultimately, ensure that the programme is cost-efficient and effective in restoring and maintaining watershed functions compared to 'business as usual'.

The business case covers the upstream and midstream pilots of Rejoso watershed, the first phase of the Rejoso Kita initiative implemented by a consortium coordinated by Social Investment Indonesia Foundation, World Agroforestry Centre (ICRAF), Collaborative Knowledge Network (CK-Net), TNC and partners supported by the Danone Ecosystem Fund. At the end of this document, a 'roadmap' presents four follow-up strategies, which cover further interventions in the downstream of Rejoso to guarantee comprehensive and integrated watershed and water resource management that simultaneously enhances local welfare and stimulates a change of behaviour to reduce the local water footprint.

- **Upstream and midstream:** operational and sustainable payment for ecosystem services schemes for increasing watershed infiltration capacity and reducing sedimentation rates
- **Downstream:** water resource engineering for increased efficiency and security
- **Downstream:** climate-smart paddy rice cultivation (water efficient and low emission)
- **Cross-cutting livelihood options:** upstream, midstream and downstream

## Rejoso Business Case in Numbers

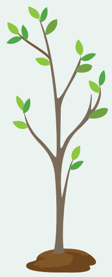
**62,773 HECTARES**
Rejoso Watershed features rice fields (29%), complex agroforestry (25%) and horticulture (10%) in 2015

**60%**
Increment of upstream horticulture, 1990–2015

classified into **8 CLUSTERS IN 3** geological elevations: upstream, midstream and downstream

**24% TO 46%**
Surface run-off in upstream horticulture compared to tolerable soil loss

**1.5% TO 2%**
Decreased surface run-off by planting 500 trees



**0.5% TO 1%**
Increase in infiltration by planting 500 trees

**18% TO 43%**
Efficiency ratio between the upstream PES contract value and business as usual cost estimation for tree-planting activities

**3% TO 14%**
Efficiency ratio between the midstream PES contract value and AQUA cost estimation for conservation activities

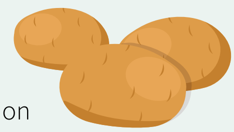
**106.6 HECTARE, 174 FARMERS, 12 GROUPS, 7 VILLAGES**

28.3 hectares and 70 farmers (upstream) and 78.3 hectares and 104 farmers joining the PES contract and verified

**€ 89 AND € 188**
Contract values per hectare for upstream and midstream farming systems annually


**1,024 HECTARE**
Area of agroforests needed for sequestering 43,838 tonnes of $CO_2$ as the target for Danone AQUA Ciherang $CO_2$ Full-Scope for insetting their business by 2025

**23% TO 40%**
Revenue increment from potato planting per hectare due to agriculture conservation techniques



**2% TO 15%**
Revenue increment from durian agroforestry per hectare owing to conservation agriculture techniques

**Midstream landscape of agroforest with rocky outcrops contributes to livelihoods and watershed functions**

Photo: World Agroforestry Centre/Beria Leimona

# 02 Introduction

Water as a source for living; Multidisciplinary research team of Rejoso Kita.
Photos: World Agroforestry Centre/Ni'matul Khasanah

The Rejoso watershed business case presents the design and establishment of co-investment in ecosystem services to support the protection and restoration of both quality and quantity of water supplies — including the national asset of Umbulan Spring in Pasuruan District, East Java — to economically important industrial regions.

Co-investment for ecosystem services implies that each who make decisions for, and benefits from, Rejoso watershed management will jointly and voluntarily invest their financial and non-financial assets (such as labour and time) to achieve the common goal of watershed sustainability.

The business case covers the creation of joint investment for increasing water infiltration and reducing sedimentation from agricultural land in the upper and middle streams of Rejoso watershed. The case shows that the co-investment principle allows self-motivation of conservation awareness and active engagement of multiple stakeholders (i.e. farmers, field facilitators, local government and corporations). Importantly, the case supports the watershed fund's distribution and management using transparent and performance-based mechanisms to ensure its effectiveness and efficiency.

Development of the business case has been led by the World Agroforestry Centre (ICRAF). The case provides an initial assessment of a joint investment scheme, its cost efficiency and potential ecological and revenue impacts at sub-watershed level.

The inputs from this business case will support the Rejoso Kita initiative that aims to conserve a healthy watershed with sustainable flow and stock of ecosystem services while simultaneously strengthening the local economy and livelihoods.

This business case highlights the PES scheme as an option for providing incentives for upper and midstream smallholders in managing their land to increase water infiltration and reduce sedimentation. The pilot PES scheme started in March 2017 and is expected to continue as more corporate and government agencies engage in integrated watershed and water resource management.

The Rejoso Kita initiative is collaboratively implemented by a consortium coordinated by Social Investment Indonesia Foundation, World Agroforestry Centre (ICRAF), CK-Net, TNC and partners supported by the Danone Ecosystem Fund. The primary data collected for the preparation of this business case originated from research coordinated by the ICRAF and Brawijaya University, Malang.

# 03
# Rejoso watershed

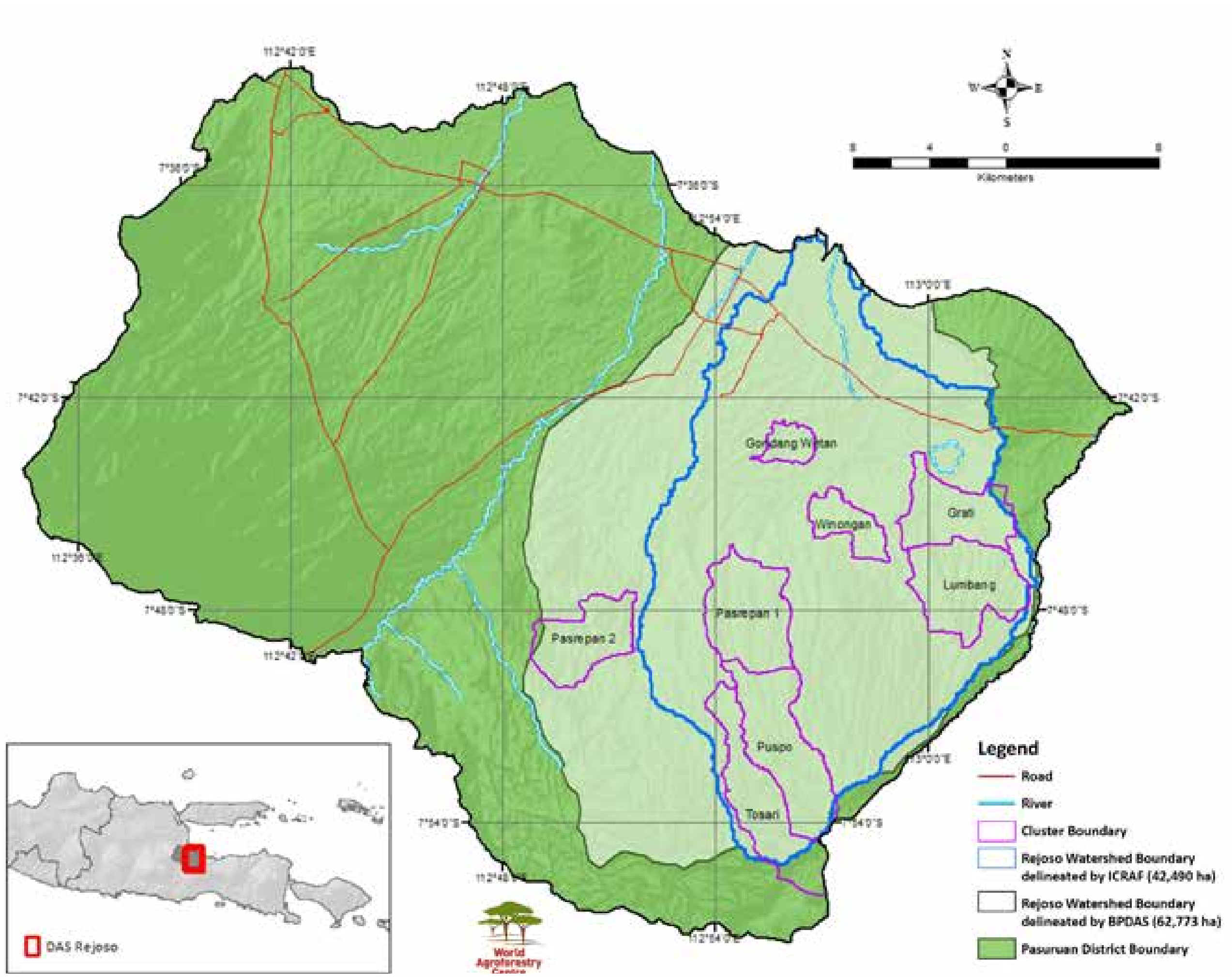



Figure 1: Location of the Rejoso Watershed in East Java, Indonesia

The Rejoso watershed, covering 16-sub districts, is located in the foothills of Mount Bromo, Pasuran District, East Java Province (Figure 1). The watershed strategically functions as the source of clean water for Pasuruan District and its surrounding districts and cities, such as Sidoarjo and Surabaya cities – the latter the metropolitan capital of East Java. Umbulan Spring — with the highest debit in Java Island — is located in the midstream of the Rejoso watershed.

The Rejoso watershed provides vital livelihoods for Pasuruan communities. Farming of annual and perennial crops, including agroforestry, timber plantations, and livestock, is the dominant source of income. In the last decade, stone mining gradually become an alternative source of income for the communities in the midstream area of the watershed. In the upper stream of the watershed, adjacent to Mount Bromo, tourism is an alternative local revenue.

Population growth and economic pressures are causing dramatic changes in the Rejoso watershed. Anthropocentric development activities have been gradually affecting the environment's quality, especially the watershed's function of maintaining good quality and quantity of water (Box 1). The most common environmental issues are floods, droughts, erosion and landslides.

Water utilization by Rejoso communities. Photos: World Agroforestry Centre/Beria Leimona

### Box 1: Rejoso watershed degradation

Information from CK-Net, a partner of Rejoso Kita initiative, indicates that the Umbulan debit has been constantly decreasing during 2007–2014. Ground water experienced a deficit of up to 5144 litres per second. The debit was estimated at about 3896 litres per second and extraction was about 9039 litres per second (Figure 2).

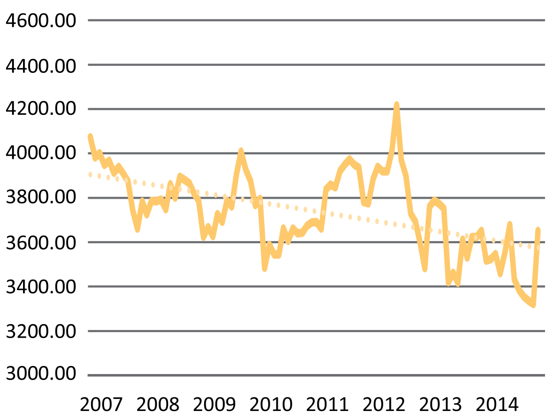



Figure 2: Water quantity measured at Umbulan Spring (Source: CK-Net)

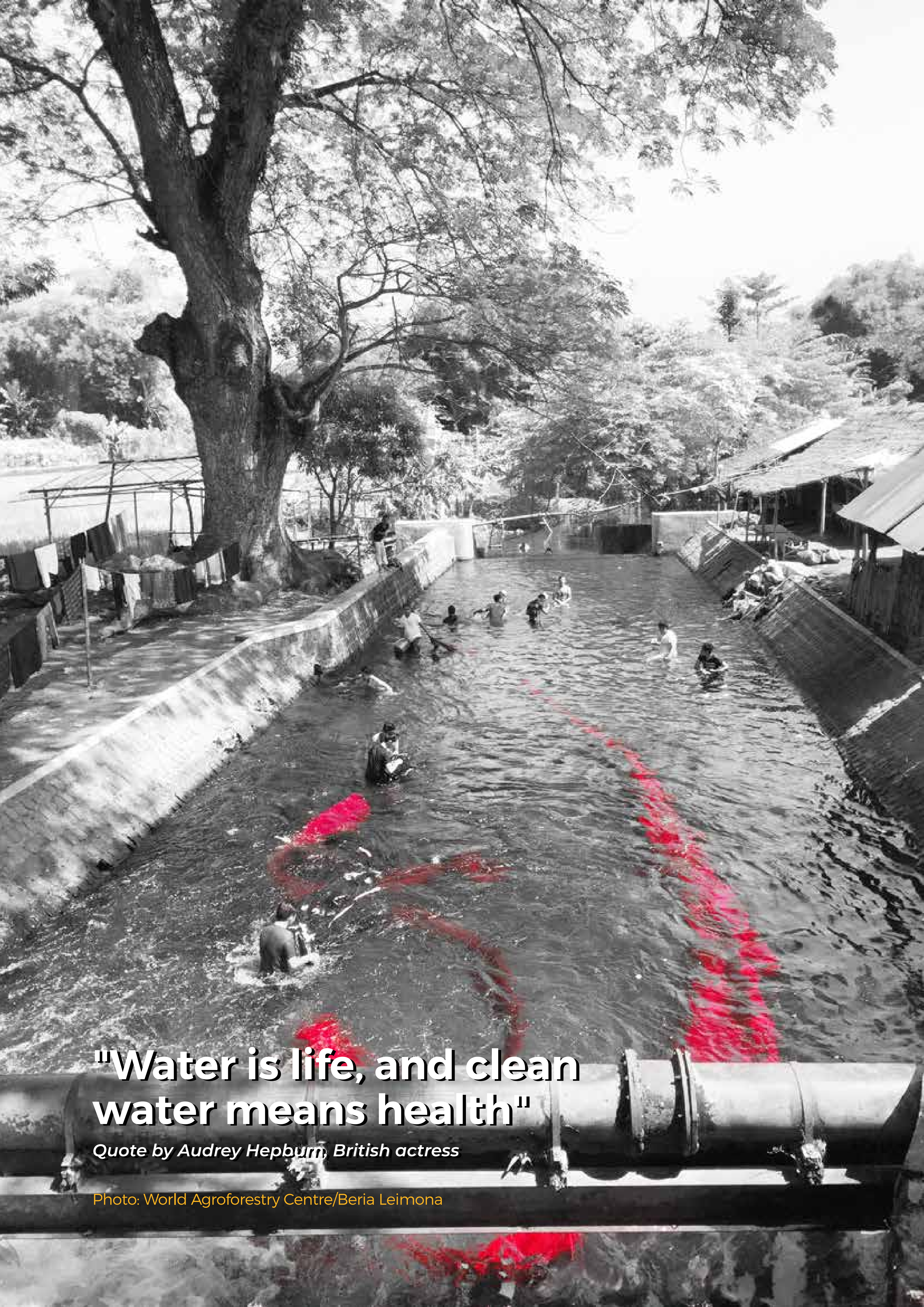
CK-Net also reports that the water quality of Rejoso River was low. Concentrations of biochemical and chemical oxygen demand were high, indicating high pollution in the waterbody.

### Box 2: Water-related problem from local perspective: male and female

The local communities have good knowledge of the degree of exposure and locations of water-related problems in the watershed.

- Floods occur mostly in lowlands surrounding flat riparian areas.
- Drought occurs in areas with rocky outcrops with patchy trees, usually in villages with inadequate infrastructure and far from water bodies.
- Soil erosion occurs on sloping land on which farmers do not apply conservation agriculture techniques.
- Landslides occur in areas with a low density of trees, steep cliffs and sloping land with fragile soil, and close to watercourses.

Strategies to overcome such water-related problems are diverse. The strategy can be to adapt and mitigate the problems. In our focus-group discussions, we found that women proposed more strategies compared to men. To deal with drought and its consequences, women took action, such as finding new sources of water, buying water and improving skills, particularly, to avoid crop failure. Men only mentioned the need to reduce their water use during the drought. To avoid floods, droughts and soil erosion, both women and men suggested mitigation activities, such as establishing and improving the quality and quantity of infrastructure, planting trees, applying conservation agriculture techniques, and improving social awareness and collective action.



**"Water is life, and clean water means health"**

***Quote by Audrey Hepburn, British actress***

Photo: World Agroforestry Centre/Beria Leimona

# 04
# The Rejoso watershed under pressures

## 4.1 Land cover changes

The Rejoso watershed covers 62,773 hectares, according to the Indonesian Central Management for Watersheds (BPDAS). The boundary embraces both Rejoso and Petung watersheds. The dominant land uses (2015) were rice fields (29%), complex agroforestry (25%) and horticulture (10%) (Figure 3). Horticulture, particularly in the upstream, is increasing, with potential to add more pressure on the watershed. Horticulture in the watershed typically is carried out with intensive management deploying chemical fertilizers and pesticides and no conservation techniques on sloping land. During 1990–2015, the conversion of agroforests to paddy rice, monocultural tree plantations and horticulture increased pressure on watershed functions and services.

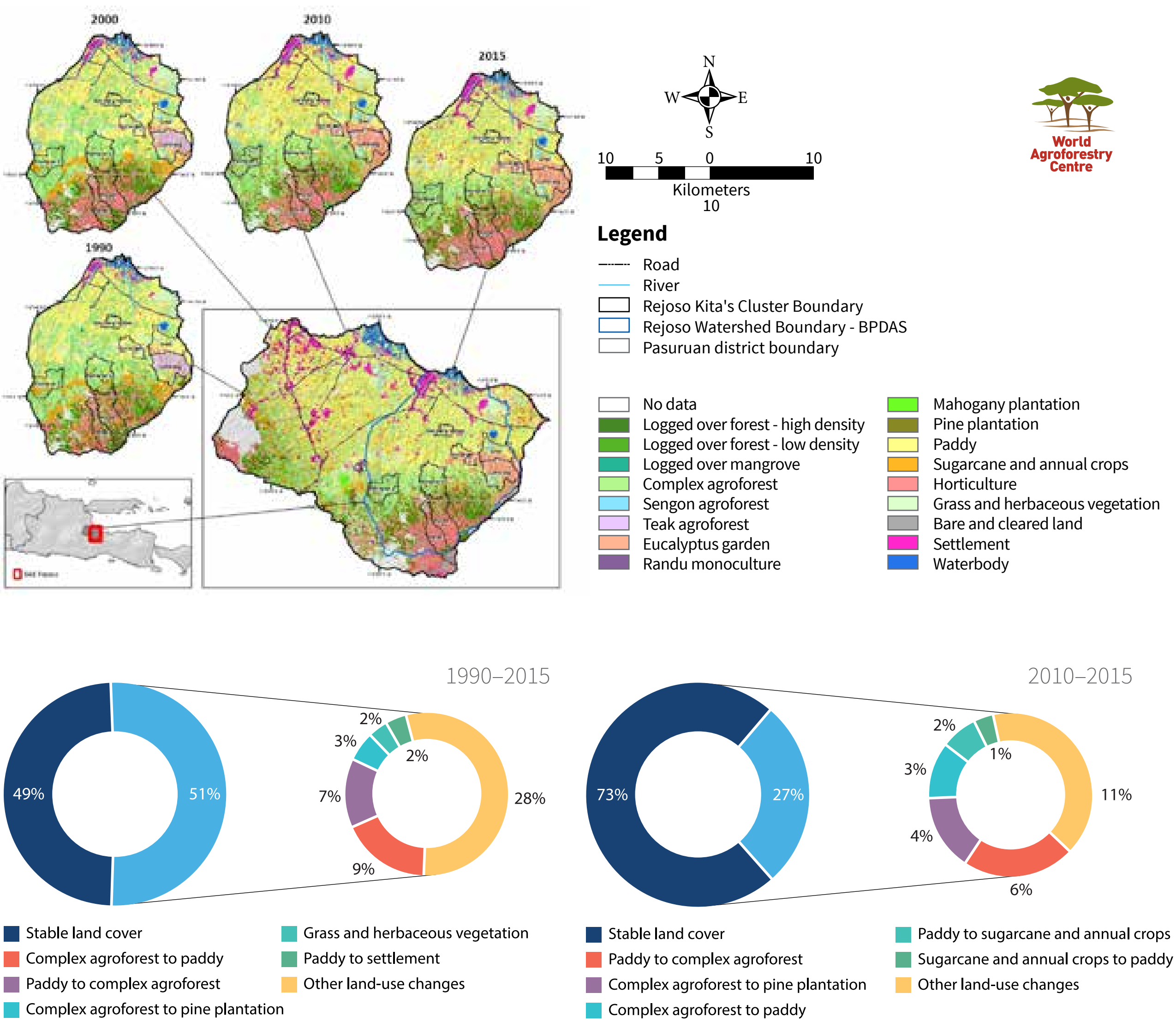



Figure 3: Trajectory of land-use and land-cover changes in Rejoso Watershed

## 4.2 Landscape typology: upstream, midstream and downstream clustering

*A cluster is a landscape consisting of several jurisdictional areas, including sub-districts and villages with similar biophysical and socioeconomic characteristics.*

The Rejoso watershed is classified into eight clusters in three geological elevations — upstream, midstream and downstream — that reflects the distinctive socioecological characters of each area (Figure 4). This cluster classification is an important step for further planning, assessment, evaluation and management of a landscape as a dynamic, complex, spatial system. The classifications are based on several factors, listed below.

- Elevation (upstream, midstream, downstream)
- Dominant land cover and farming systems, rocky outcrops, farming practices
- Tenure status
- Poverty status (targeting low-to-middle incomes), sources of income, ethnicity and culture

### 4.2.1 Upstream cluster

The upstream clusters are characterized by smallholders practising intensive horticulture on undulating land, with relatively high incomes from commercial annual crops (potatoes and spring onions) and tourism businesses near Mt Bromo. During 1990–2015, horticulture increased to more than 60% of the total cluster area. The overall land-use and land-cover changes were dominated by horticulture converted from various land uses, such as pine plantations and complex agroforests. With pressure from tourism businesses,

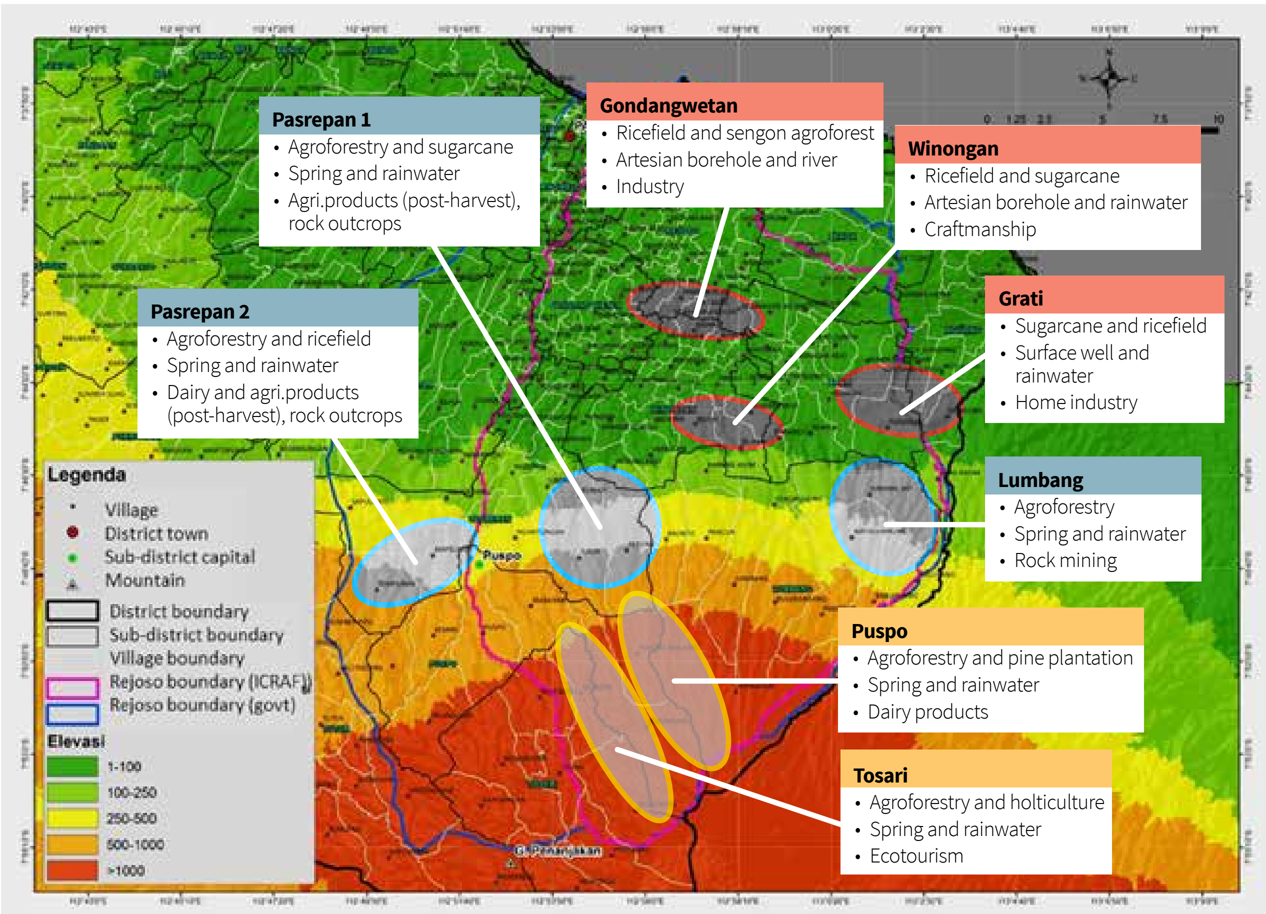



Figure 4: Location of cluster and its characteristics

the local community have predicted that land-use change in the next decade will be dominated by continued conversion to horticulture and settlements. They are aware that this conversion might increase the risk of landslides, particularly, in sloping areas and reduce the number of springs and green open spaces.

Farmers cultivate horticultural commodities, such as potatoes, cabbage, spring onions and maize, combined with border and shading trees on both private and public land (i.e. community forests and state forest company land). 'Cemara' (*Casuarina junghuhniana*) and acacia (*Acacia mangium*) were planted to reduce erosion on agricultural land. In addition, the community also planted grass strips to provide fodder for their cows and pigs. Complex agroforests, called 'tegal', are mostly found in Puspo. They typically feature various timber and non-timber commodities, such as cemara, 'sengon' (*Paraseriantehs falcataria*), mahogany (*Swietenia mahogany*), acacia, cloves (*Syzygium aromaticum*), coffee, bamboo, gmelina (*Gmelina arborea*), jackfruit (*Artocarpus heterophyllus*), avocado (*Persea americana*) and sweet potatoes, potatoes, cabbage and grass.

### 4.2.2 Midstream clusters

The midstream clusters are dominated by tree-based farming systems and complex agroforests, in which smallholders grow timber, fruit and commercial perennial crops, such as coffee and clove, on single plots.

The complex agroforestry covers 50–60% of the area although there is an increased trend toward increased planting of sengon and teak (*Tectona grandis*) for commercial timber, pulp and paper. Farmers' preferences for tree-based systems with simpler structure is noticeable. During 1990–2015, sugarcane and annual crops were converted to pine plantations while complex agroforests were converted to sengon-dominated agroforests. The local communities have predicted that in the coming decade, settlements, sengon and complex agroforests will expand. Sengon is considered a good investment, with access to markets, for increasing household income and also domestic use for building material.

Farming systems in these clusters are dominated by complex agroforests ('kebun campur'). Generally, the systems include various tree commodities, such as sengon, durian (*Durio zibethinus*), jackfruit, mango (*Mangifera indica*), 'petai' (*Parkia speciosa*), 'kapok' (*Ceiba pentandra*), clove and coffee, combined with seasonal crops, such as corn, cassava and 'empon-empon' (medicinal plants, such as ginger and turmeric). The communities also grow tree crops in their homegardens, such as durian, rambutan (*Nephelium lappaceum*), jackfruit, mango, mangosteen (*Garcinia mangostana*), petai and chili.

### 4.2.3 Downstream clusters

The downstream clusters are relatively diverse, dominated by rainfed and irrigated paddy fields, complex agroforest, sugarcane and annual crops, grass and herbaceous vegetation. Settlements are spread around the paddy fields and complex agroforests. During 1990–2015, paddy fields decreased and *Melaleuca* plantations increased. Teak agroforests disappeared in 2000 and then reappeared at an annual rate of 2% for the next 10 years. Rice cultivation remains the dominant source of income and staple food.

The local community estimated that over the next 10 years the paddy fields and cleared land would be converted to settlements as the need for housing increases. The complex agroforests were predicted to remain the same because they were sources of income and investments for inheritances. Common perceptions of the drivers and patterns of land-use and land-cover changes were that there was a preference for complex agroforestry systems because they produced surplus commodities that could be shared with poorer neighbours. The sengon agroforests were predicted to remain stable because there were also sources of income and investment for the communities.

The communities in the downstream of the Rejoso watershed mainly cultivates rice as well as maize, vegetables, taro and, occasionally, sugarcane. On the borders of the

Table 1: Landscape characteristics of cluster

| Position in the watershed | Downstream | Midstream | Upstream |
|---|---|---|---|
| **Clusters/Sub-districts** | Grati, Winongan, Gondangwetan | Pasrepan, Lumbang | Tosari, Puspo |
| **Livelihood source** | Paddy (upland and irrigated rice) and other crops (sugarcane, maize, peanuts) | Paddy (upland rice), fruit trees and dairy production | Horticulture and dairy production |
| **Dominant land use** | Rice field, sengon and cajuput garden | Agroforest, sengon and cajuput garden | Horticulture and pine forest |
| **Arable land** | Private and Government Forest Plantation Company (Perhutani) | | |
| **Ethnic** | Madurese, Javanese | | Tengger, Javanese |
| **Water shortage** | Yes | Yes | No |
| **Dominant water source** | Surface wells and artesian boreholes | Springs and rain water | Springs and rain water |

paddy fields ('tegalan'), farmers plant various fruit and timber crops, such as bananas, snake fruit (*Salacca zalacca*), 'melinjo' (*Gnetum gnemon*), teak and sengon. The communities mostly cultivate agroforests, sengon plantations and homegardens on private land. Timber plantations on community land (i.e. 'community forest') are dominated by teak and sengon combined with fruit trees, such as bananas, jackfruit and mango. *Melaleuca* and teak agroforests owned by Perhutani, a state-owned forestry enterprise, are present in all villages.

Farmers in Gondangwetan usually lease their sugarcane land to companies or investors and do not manage the plantations by themselves because of the limited access to the value chains of the processing companies. Some members of the community also manage small-scale fish ponds in their homegardens, mostly for their own consumption.

**Box 3: Tree selection criteria and preference**

A landscape restoration programme through planting trees will only be successful if the implementer understands why communities choose certain types of trees.

To understand the local farming systems and communities' preferences in selecting tree species, we conducted a series of focus-group discussions with both male and female farmers in the three clusters. The discussions revealed that

- financial motivation, such as good prices and higher revenue, dominated selection of particular tree species
- women prioritized domestic consumption and environmental and conservation aspects compared to men, who prioritized market access and other economic criteria.
- Consistent with the current farming systems, fruit and timber trees were preferred by smallholders in the downstream, who mostly grew agroforests, rather than by smallholders in the upstream.
- The local communities were familiar with tree suitability and could match particular areas with particular species.
- Several species of trees were prioritized by communities:
  - Upstream: cemara, bamboo, clove, coffee
  - Midstream: durian, sengon, coconut, jackfruit, clove, kapok
  - Downstream: sengon, kapok, coconut, mango, banana, teak, jackfruit

**Upstream**

In the upstream cluster, both the female and male groups showed a high degree of environmental awareness reflected in their tree-selection criteria. The female group chose 'disaster prevention' as the main criterion, mainly related to the function of strengthening the soil to prevent landslides and erosion on their agricultural land. The male group chose 'protection of water sources' as the main criterion in selecting tree species, particularly, to maintain water quantity from the springs and 'prevent landslides'. Both male and female groups chose cemara as the priority because of the multiple benefits it provided, including landslide prevention, firewood and land-boundary delineation. In addition, mature cemara can be sold as timber for construction material.

**Box 3: Tree selection criteria and preference (cont.)**

**Midstream**

The male and female groups in the midstream cluster similarly stated durian, jackfruit, sengon, petai and mango as their preferred commodities. Both groups chose durian as the prioritized tree commodity. Durian provides most household income because of its high marketability and suitability with growing conditions. In addition, durian could also be used as a saving or investment because it could be harvested after several decades. The timber can be sold when the trees stop yielding fruit.

**Downstream**

The male group considered 'fast yield', 'high market price' and 'marketability' as the most important criteria. The male group also chose 'easy maintenance', particularly, for commodities that do not require a lot of water. 'Saving and investment' was also chosen by this group, mostly related to the function of timber commodities.

Male and female groups in the downstream clusters selected quite diverse commodities but mostly listed sengon or teak as one of their preferred commodities. These species were preferred because of their high sale price, their function as a medium-term financial saving, and good marketability. Fruit crops were also preferred, such as rambutan, durian, jackfruit, avocado and longan. These fruits contribute to household income because they are relatively easy to sell.

## 4.3 Soil condition and management for infiltration-friendly farming systems

This section is based on research activity and report of the University Brawijaya, Indonesia[1].

The infiltration rate is determined by the above- and below-ground condition of trees and soils (Figure 5). Forests and agroforests with high canopy and root density and high input of litter are examples of land cover with high infiltration rates and low surface run-off whereas crop monocultures with low input of litter have low infiltration rates and high surface run-off.

A litter layer of vegetation debris increases soil surface roughness and increases the infiltration rate. Decomposed litter provides energy sources for macro- and micro-organisms that form soil macropores.

The soil profiles in the upstream and midstream of Rejoso contain sufficient plant nutrients and support most types of plants with appropriate control of erosion or drainage (Figure 6). In the midstream, the soil conditions (i.e. entisol) indicate unstable environments, such as floodplains, erosion or those found on steep slopes. In the upstream, andosol is the characteristic soil of volcanic areas.

Figure 7 illustrates soil types and land-cover distribution in the upstream and midstream of Rejoso watershed where infiltration rates were measured. The upstream area with horticultural land cover, andisol soil type, 45% to more than 65% slope, and less than 55% canopy cover, produces 24–46% surface runoff (Figure 7A) and erodes soil at rates much higher than tolerable (Figure 7B). A similar pattern was found in the midstream area with inceptisol soil type (Figure 7C and D).

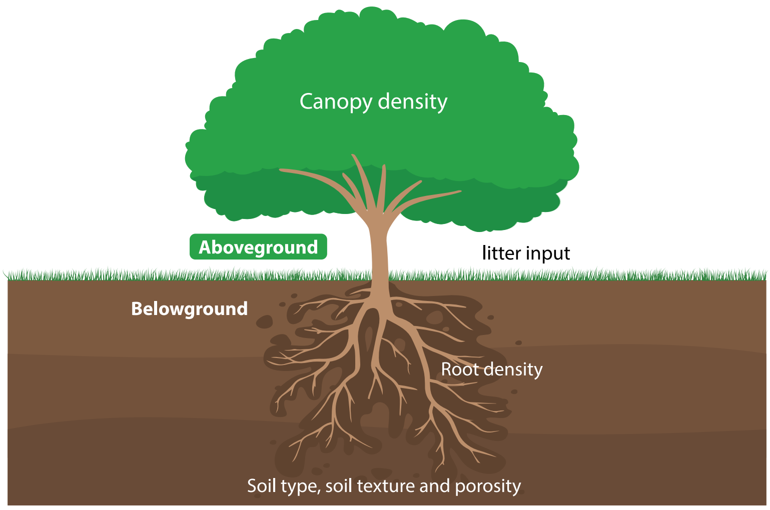



Figure 5: Factors determining infiltration rate

[1] Suprayogo D, Widianto, Saputra D, Sari RR, Maulana R, Sutanto TD, Hairiah K. 2018. *Sistem Penggunaan Lahan "Ramah Infiltrasi" di DAS Rejoso Jawa Timur*. Malang, Indonesia: Universitas Brawijaya.

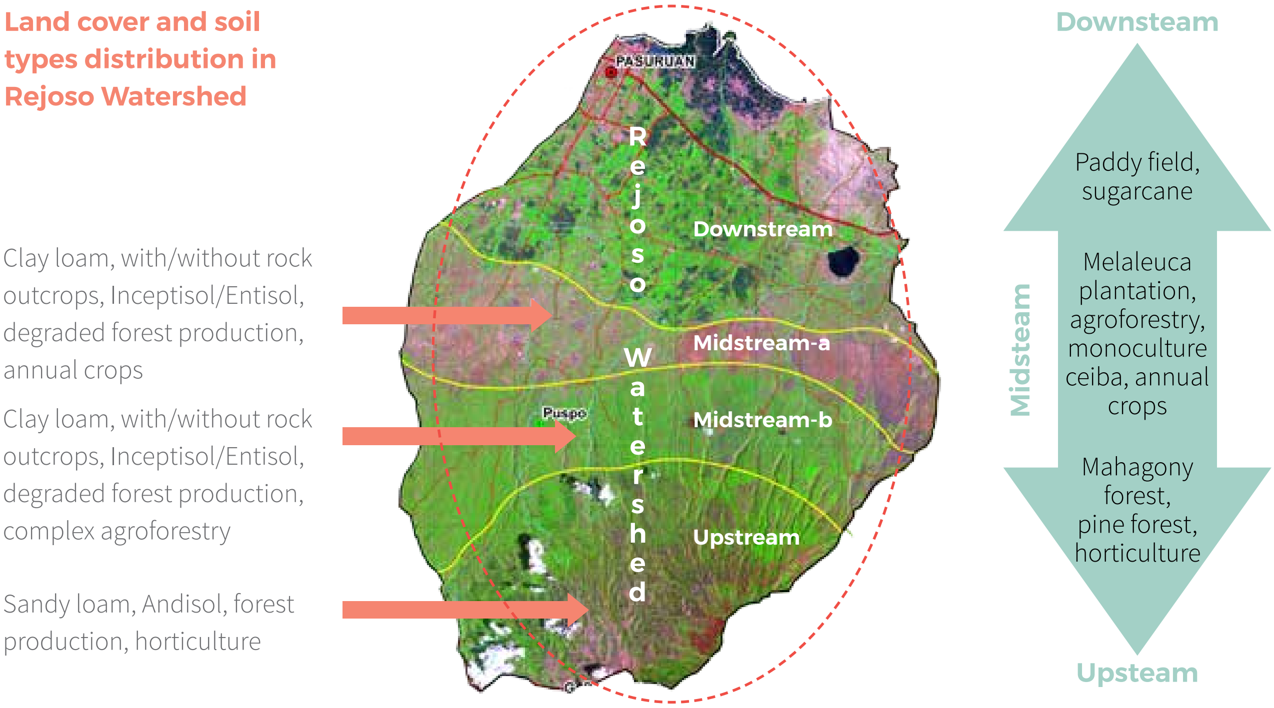



Figure 6: Profile of soil and land cover in upstream and midstream of Rejoso watershed

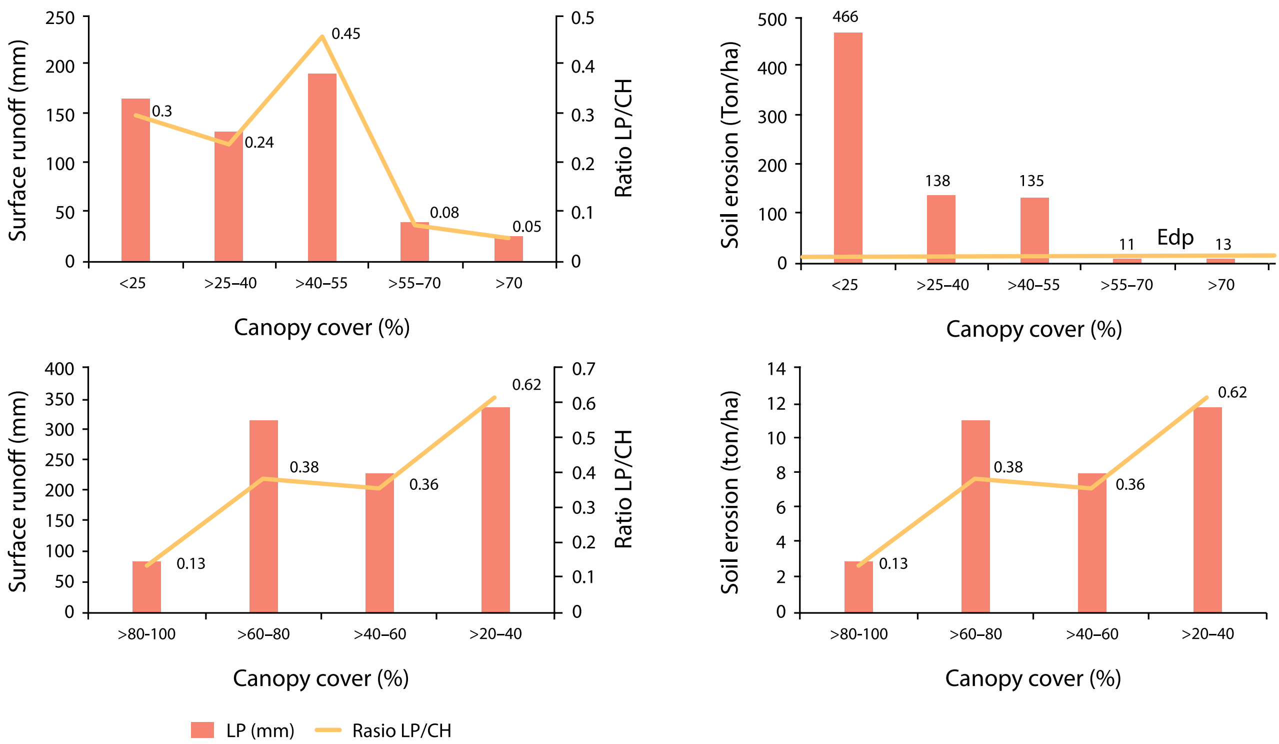



Figure 7: Surface runoff and soil erosion of various land cover and canopy density in Rejoso watershed

Note: (A) upstream surface runoff; (B) upstream soil erosion; (C) midstream surface runoff; (D) midstream soil erosion. Legend of figure: LP: surface runoff, CH: rainfall, EDP: tolerable soil loss


# Conservation auctions for behavioral changes and cost efficiency

Photo: World Agroforestry Centre/Beria Leimona

# 05
# Piloting co-investment for ecosystem services schemes

## 5.1 Designing payment for ecosystem services (PES) schemes

The focus of PES in Rejoso watershed is at the upper and midstream clusters. Smallholders' practices in this production landscape influence the flow of ecosystem services (ES) utilized in the downstream clusters. In the upstream and midstream cluster, the pressure to intensify agricultural practices and convert to monoculture farming systems is high. Increased water infiltration and reduced soil erosion are two important watershed functions that can be generated from both clusters to improve the quality of the watershed in general and, particularly, the downstream water supply. Prospective actions to improve those two functions are 1) upstream: increase numbers of trees on smallholders' horticultural farms and deploy simple soil and water conservation techniques, i.e. bench terracing and vegetative strips; 2) midstream: maintain and increase density of agroforestry practices and deploy simple soil and water conservation techniques, i.e. sediment pits and bench terracing.

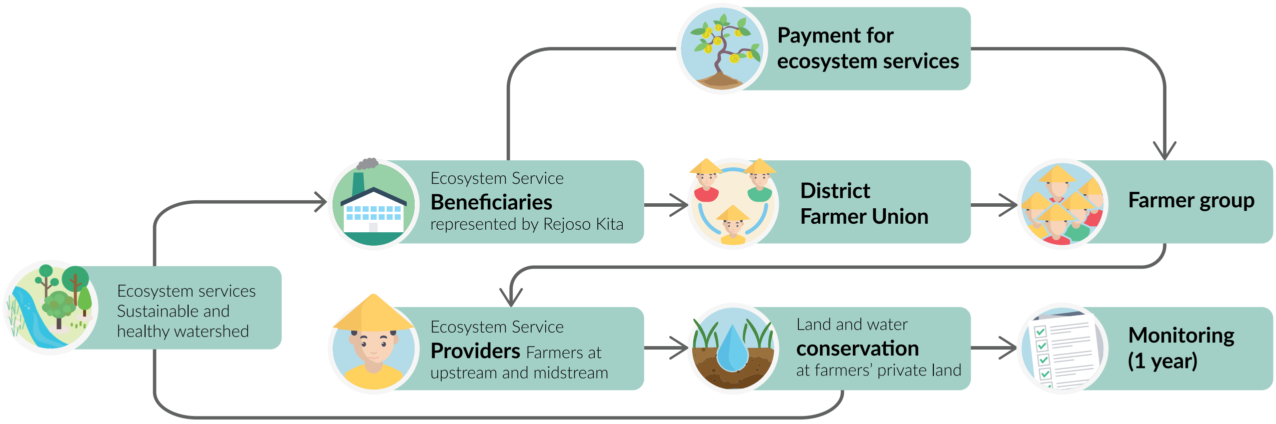



Figure 8: The payment for ecosystem service scheme in Rejoso Watershed

Table 2: Conservation activities for PES in upstream and midstream clusters

| Watershed management | Upstream | Midstream |
|---|---|---|
| Tree planting and maintenance | • 300 cemara trees per hectare distributed evenly on farms<br>• Not allowed to cut trees except if agreed in consultation with the village head<br>• Dead trees must be replaced | • Trees planted at least 500 per hectare with maximum 50 of sengon (timber tree)<br>• Not allowed to cut trees except if agreed in consultation with the village head<br>• Dead trees must be replaced |
| Crop maintenance | • Allowed to clear weeds<br>• Allowed to prune cemara ('nutui') | • Allowed to clear weeds<br>• Allowed to prune trees to maintain productivity |
| Soil and water conservation techniques | • Grass strips along drainage channels and parallel with contours, minimum 50% of an area | • 200 sediment pits per hectare of size 50 x 50 x 40 cm or terraces with vegetative strips, minimum 50% of an area |
| Litter management | Not allowed to clean the litter | |
| Monitoring | Must keep tree name-tags<br>Must keep and maintain the monitoring tools/instruments | |

**Box 4: Why does the conservation agreement requested farmers to plant 300 trees in the upstream and 500 trees in the midstream?**

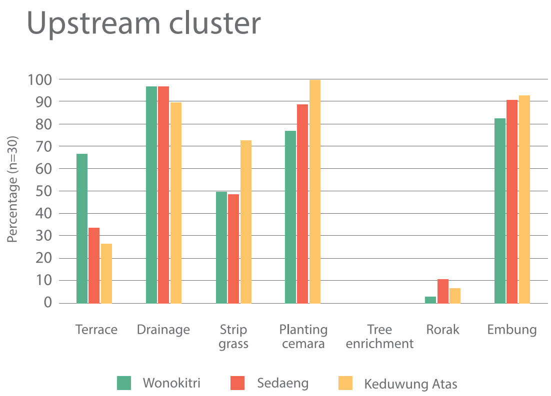
Smallholders in the upstream cluster prefer cemara (*Casuaria junghuniana*), a native species of the Bromo mountainous ecosystem. They understand that cemara's narrow, cone-shaped canopy allows ample sunlight for their potatoes. The canopy can also trap Bromo's ash during eruptions.

In the upstream cluster, Perhutani, the Government's forestry company, has applied good agricultural practices in intercropping potato and cemara using high-quality potato seedlings and an optimal planting distance of 6 x 2 metres or 833 trees per hectare. This is an ideal situation for upstream conservation. However, our household survey revealed that the potato farmers in the Rejoso upstream only planted the cemara along the borders of their fields, roughly 100–200 trees per hectare. As a compromise, the conservation contract offered 300 trees per hectare as was agreed during the community discussion. This will be a gradual transition toward the optimal planting distance as practised by Perhutani.

In the midstream cluster, smallholders mainly deploy various agroforestry practices, with durian, mango and coffee being the main commodities. The tree density per hectare in these agroforests is 300–400, with some farmers exceeding the range, as recorded by the household survey. For the conservation contract, the agreement made was 500 trees per hectare to provide a realistic number based on the current situation and reflecting the optimal planting distance applied by a community/social forestry ('kehutanan sosial') scheme.

Farmers in both upstream and midstream have basic knowledge of water conservation, such as installing grass strips, sediment pits and drainage channels, and practice these techniques intermittently. The PES scheme will encourage them to maintain these conservation practices more determinedly on their farms.

The figures below illustrate farmers' knowledge of soil and water conservation activities and tree species' preferences at household level in the midstream and upstream clusters.



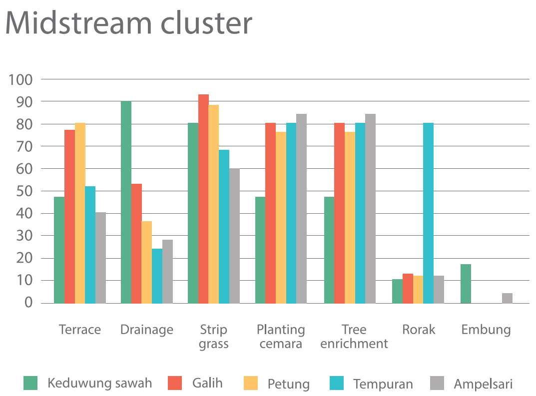




Table 3: Schedule and payment allocation for the upstream conservation agreement

| Performance of contracted activity | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Contract-signing and first payment | | | 40% payment | | | | | | | | | |
| 100% strip-grass planting 100% availability cemara seedling | | | | | | | | | | | | |
| 80% cemara planting | | | | | 70% payment | | | | | | | |
| Cemara planting 100% | | | | | | 100% payment | | | | | | |

Note: The month-1 is starting on March 2018

Table 4: Schedule and payment allocation for the midstream conservation agreement

<table>
<tr><th rowspan="2">Performance of contracted activity</th><th colspan="12">Month</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th></tr>
<tr><td rowspan="2">Contract-signing and first payment</td><td></td><td colspan="11"></td></tr>
<tr><td colspan="4">30% payment</td><td colspan="8"></td></tr>
<tr><td>50% sediment pits per hectare or strip-grass planting 60% tree planting</td><td colspan="3"></td><td colspan="9"></td></tr>
<tr><td rowspan="2">200 sediment pits/ha or strip-grass planting and 500 trees/ha</td><td colspan="3"></td><td colspan="6"></td><td colspan="3"></td></tr>
<tr><td colspan="8">60% payment</td><td colspan="4"></td></tr>
<tr><td rowspan="2">200 sediment pits/ha and 500 trees/ha</td><td colspan="9"></td><td colspan="3"></td></tr>
<tr><td colspan="12">100% payment</td></tr>
</table>

Note: The month-1 is starting on March 2018

## 5.2 Value of contract agreement

To determine the conservation contract values, ICRAF conducted two conservation auctions. The upstream and midstream have different conservation contract arrangements, hence, two contract values were needed. The conservation auction method mimics market transactions and negotiation techniques to elicit the willingness-to-accept of smallholders. The conservation cost for each individual is private (Box 5). The auction process aims at increasing farmers' awareness of the benefit of conserving their farm land, at least in the long-term, and allows discussion among farmers and facilitators. In Rejoso, the team conducted the auction at both individual and group levels as group contracts were preferable and reflected grassroots' collective actions. The group auction resulted in more realistic and efficient bids compared to the individual ones. We assumed there was a more effective information exchange among smallholders. Figure 9 shows the complete process of the auctions starting from focus-group discussion, auction, land verification for the winners, contract signing and periodic monitoring. Tables 1, 5 and 6 show results from the two conservation auctions at individual and group levels in the upstream and midstream. At the group level, with interaction among farmers' group members, the bidding levels decreased as farmers started to understand the auction process and the benefits of conservation activities.

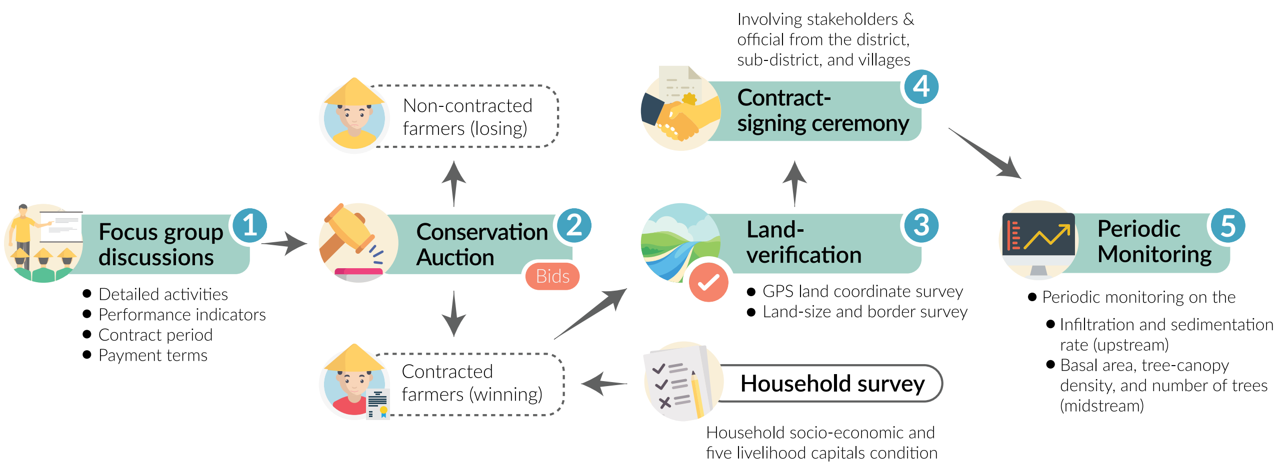



Figure 9: Flow of activities from auction to PES contract implementation

Table 5: Individual and group auction results for upstream

| Component | Unit | Individual | Group |
|---|---|---|---|
| Total participants | Persons/ groups | 70 | 7 |
| Total submitted land | hectare | 39.925 | 39.82 |
| Total bids | IDR | 6,200,600,000 | 579,423,500 |
| Bid per hectare | | | |
| Average | IDR | 15,365,028 | 3,937,652 |
| Median | IDR | 6,000,000 | 3,000,000 |
| Min bid | IDR | 200,000 | 1,701,743 |
| Max bid | IDR | 140,000,000 | 12,000,000 |
| Total winner | Persons/ group | 25 | 4 |
| Total winning land | hectare | 16.22 | 25.94 |
| Cut-off price | IDR/hectare | 4,511,500 | 3,196,347 |
| Total contract value | IDR | 91,416,800 | 94,725,926 |

Table 6: Individual and group auction results for midstream

| Component | Unit | Individual | Group |
|---|---|---|---|
| Total group | Persons/ group | 135 | 11 |
| Total submitted land | hectare | 119.46 | 123.38 |
| Total bids | IDR | 542,500,000 | 257,902,050 |
| Bid per hectare | | | |
| Average | IDR | 5,295,305 | 2,273,083 |
| Median | IDR | 2,976,190 | 1,470,899 |
| Min | IDR | 200,000 | 976,190 |
| Max | IDR | 50,000,000 | 5,000,000 |
| Total winners | Persons/ group | 54 | 5 |
| Total winning land | hectare | 50.67 | 64.40 |
| Cut-off price | IDR/hectare | 2,000,000 | 1,470,899 |
| Total contract value | IDR | 96,340,000 | 100,500,000 |

**Box 5: Why conservation auction in determining contract values and targeting PES participants?**

PES programmes are often, if not always, implemented in a situation in which the available budget to create incentives for the ES providers is limited. In such situation, it is important to ensure that the PES programme allocates the conservation budget in a way that ensures *fairness* (meaning that the incentive can meet the providers' expectation) and *effectiveness* (the available resources can be allocated to involve ES providers at the lowest cost for as many as possible to conserve the ES).

The exact amount of incentive required by providers to carry out actions that can enhance ES is hidden information. If the incentive is too low, it will not motivate ES providers to improve their land-use practices and provision of ES. If the incentive is too high, the PES will fail to provide environmental services effectively from the available resources. The limited information on the incentive level necessary to motivate behavioural change in the absence of competitive markets for ES and to determine who should participate in the pool of potential participants are the main challenges for the implementation of a successful PES programme.

A conservation auction is an alternative mechanism for revealing the hidden information from ES providers on levels of payments or incentives that will cover their opportunity costs and/or expectation when joining a PES programme. This type of auction applies the reverse auction method, in which the lowest bidder(s) will be the winner of the auction.

The conservation auction aims to reveal the lowest feasible contract price based on farmers' bid. The bid must include the cost to change the behaviour (the opportunity cost and gain expectation of doing conservation activities). This process can facilitate to achieve the fairness of the programme implementation, as the providers will provide their bid realistically based on their opportunity cost and incentive preference.

The conservation auction is also an efficient way to target the right participants with the lowest opportunity cost to provide the ecosystem services. The programme can select the lowest bidders in the conservation auction as the potential PES participants based on the availability of incentive budget.

Prior to the auction, however, the PES programme implementer or intermediary is required to identify the potential auction participants, raise their awareness of the importance of conservation, and build their capacity for the conservation auction. The PES intermediary can carry out these activities through various methods, such as focus-group discussions, meetings, questionnaire survey and observation. Ensuring that farmers understand the purposes of auctions for effective PES contract allocation beyond a mere game and make them aware of the importance of conservation is necessary to increase the likelihood of success of the PES programme.

## 5.3 Cost efficiency by applying co-investment scheme

Through the participatory, yet competitive and market-like, process of a conservation auction, the contract value is relatively more efficient compared to the cost of tree-planting projects estimated by 'top-down', flat rates. In most cases, when a conservation programme determines its cost, the calculation is based on the market price of inputs for the activities (i.e. materials, labour, tools). This calculation does not reflect the conservation awareness, altruism and

Table 7: Unit prices of tree planting and sediment trap construction in two corporate-social-responsibility (CSR) project

| Activities | Unit price (IDR) |
|---|---|
| Tree planting (Company A) | 50,000 |
| Tree planting (Company B) | 15,000 |
| Sediment trap construction (Company A) | 100,000 |

Table 8: Efficiency ratio between the upstream PES contract value and CSR project cost estimation for conservation activities

| Activity | AQUA cost estimation (IDR) | Assumption |
|---|---|---|
| 300 trees | Min: 4,500,000<br>Max: 15,000,000 | Price of Cemara is similar to other trees bought in the company's CSR projects |
| Grass strips along the drainage channel and parallel with the contour, minimum 50% area | 3,000,000 | Price of grass strips is three times that for sediment trap construction because grass seedlings are needed |
| **Total (Cost-efficiency)** | **Min: 7,500,000 (43%)**<br>**Max: 18,000,000 (18%)** | |

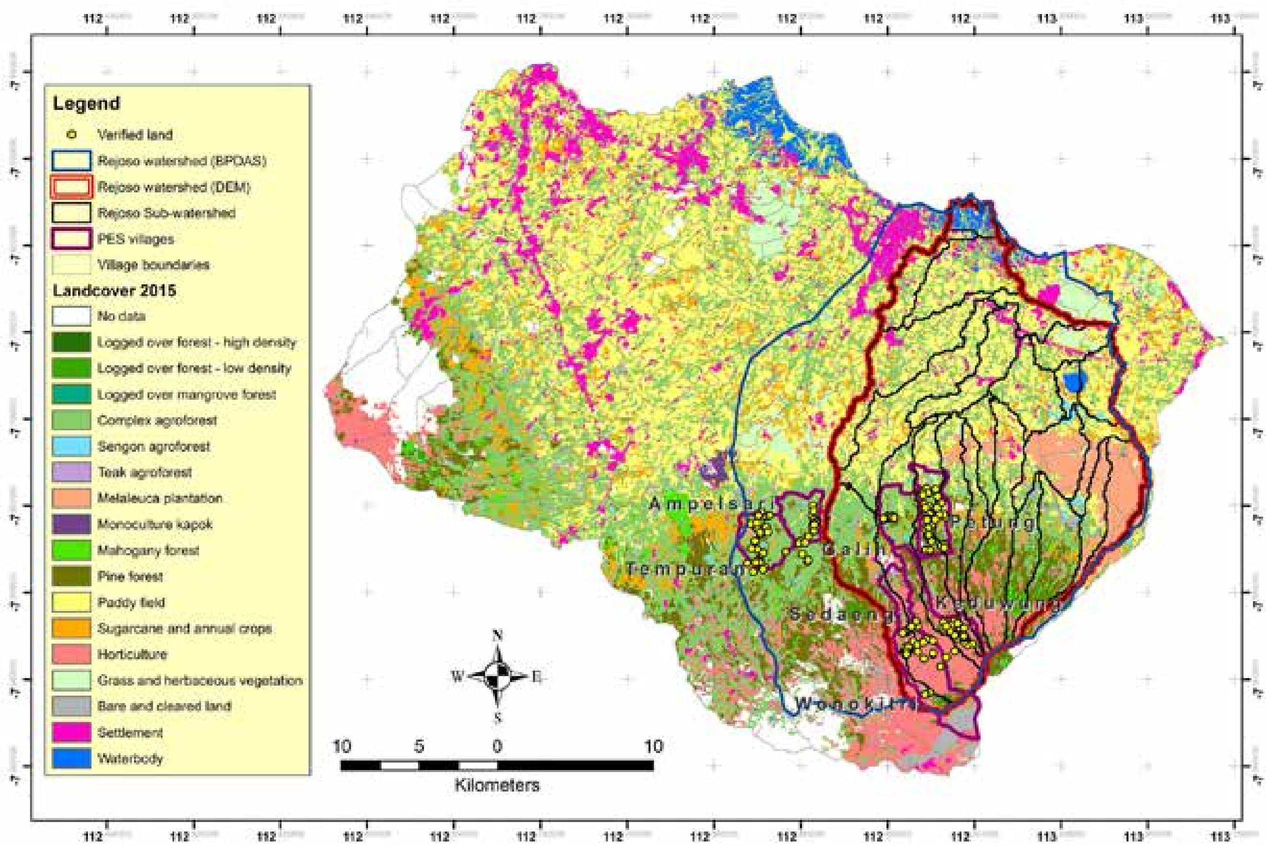



Figure 10: Distribution of PES contracted lands in Rejoso

voluntariness of the farmers engaged in the programme. The farmers might have previous awareness of conservation and understand the benefits of such a programme.

Using data of corporate-social-responsibility (CSR) programme costs at two factories (Table 7), the efficiency ratio of the PES contract valued derived from the conservation auctions ranges 18–43 per cent in the upstream cluster (Table 8) and 3–14 per cent in the midstream cluster (Table 9). Figure 10 shows the plot locations.

## 5.4 Carbon stock estimation

Agroforestry and other tree-based farming systems can sequester carbon as part of both carbon insetting and offsetting initiatives of a company. Carbon insetting is gaining in popularity because it goes beyond traditional carbon emissions offsets to build smallholders' resilience into supply chains.

In the Rejoso watershed, carbon insetting has the potential to increase the incomes of smallholders, restore watershed functions and contribute to carbon sequestration. Based on secondary data and assumption, the calculation of carbon gained from tree planting in horticultural and agroforestry areas in the upstream and midstream is presented in Table 11.

Table 9: Efficiency ratio between the midstream PES contract value and AQUA cost estimation for conservation activities

| Activity | CSR project cost estimation (IDR) | Assumption |
|---|---|---|
| 500 trees | Min: 7,500,000<br>Max: 25,000,000 | Price of Cemara is similar to other trees bought in the company's CSR projects |
| 200 sediment pits per ha, with the size 50x50x40 cm | 20,000,000 | |
| Terrace with vegetative strips, minimum 50% of area | 3,000,000 | Price of grass strips is three times that for sediment trap construction because grass seedlings are needed |
| **Total (Cost-efficiency)** | **Min: 10,500,000 (14%)**<br>**Max: 45,000,000 (3%)** | |

Table 10: List of contracted farmer groups and their villages in upstream and midstream

| | Farmer Group | Village | Area (hectare) | Number of farmers |
|---|---|---|---|---|
| Upstream | Artomoro 1 | Sedaeng | 5.7 | 11 |
| | Sidoluhur 3B | Keduwung Atas | 4.2 | 9 |
| | Sidoluhur 3A | Keduwung Atas | 4.3 | 12 |
| | Artomoro 2 | Sedaeng | 6.2 | 10 |
| | Tani Subur 1B | Wonokitri | 3.1 | 12 |
| | Tani Subur 1A | Wonokitri | 4.8 | 16 |
| | Sub total | | 28.3 | 70 |
| Midstream | Tunas Harapan A | Ampelsari | 19.9 | 18 |
| | Sumber Rejeki A | Tempuran | 7 | 11 |
| | Bina Tani A | Petung | 8.1 | 15 |
| | Sri Rejeki | Tempuran | 13.2 | 15 |
| | Sumber Rejeki_ Tempur B | Tempuran | 11.3 | 11 |
| | Sumber Rejeki | Galih | 7.9 | 13 |
| | Bina Tani B | Petung | 10.9 | 21 |
| **Sub total** | | | 78.3 | 104 |
| **Total** | | | 106.6 | 174 |

Table 11: Carbon gain calculation from tree planting of horticulture and agroforestry lands in Rejoso

| | |
|---|---|
| Tree density agroforestry area | 500 trees per hectare |
| Tree density horticulture area | 300 trees per hectare |
| Available agroforestry area | 15,834 ha |
| Available horticulture area | 6,506 ha |
| Allometric equation (Kettering et al., 2001) | $0.11 \times \dot{\rho} \times D^{2.62}$, ṗ: wood density, D: tree diameter |
| Current average diameter | 23 cm |
| Tree diameter increment | 2 cm annually |
| Wood density | 0.5 g $cm^{-3}$ |

The calculation based on above data and assumption results that tree planting in Rejoso will sequester about **42.8 ton $CO_2$ per hectare annually** or **677,777 ton $CO_2$ annually**.

**Box 6: Danone- AQUA Ciherang $CO_2$ Full-Scope**

The target of Danone-AQUA Ciherang $CO_2$ Full-Scope is 43,838 ton $CO_2$ by 2025. By using the Rejoso data (Table 9), the achievement of the target will equal to two options:

- A year of carbon sequestration by planting trees in 1,024 hectare with minimum density of 300 trees per hectare;
- 8 year of carbon sequestration by planting trees with average area of 128 hectare yearly.

## 5.5 Modeling the impact of co-investment for ecosystem service schemes

The Generic Riverflow (GenRiver) model[2] was applied to explore changes in water balance as a result of historical land-cover changes (1990–2015) and to predict changes in water balance as a result of increasing tree density on horticultural and agroforestry land (2015–2035, Table 12) at both watershed and sub-watershed levels with a 'business as usual' as a reference (conversion of agroforestry into horticulture or annual crops). Figure 11 presents a map of sub-watershed boundaries and clusters where activities to increase tree density can be implemented.

Decreasing the area of both forests and agroforestry and increasing those of horticulture and annual crops during 1990–2015 lead to increased surface water flow and decreased base flow in both dry and wet years with significant changes after 2010 (Figure 12). By increasing tree density in agroforestry and horticultural areas to around 500 per hectare will increase the infiltration rate by 0.5–1 per cent, decrease runoff by 1.5–2 per cent, and increase sub-surface flow and base flow (Figure 13).

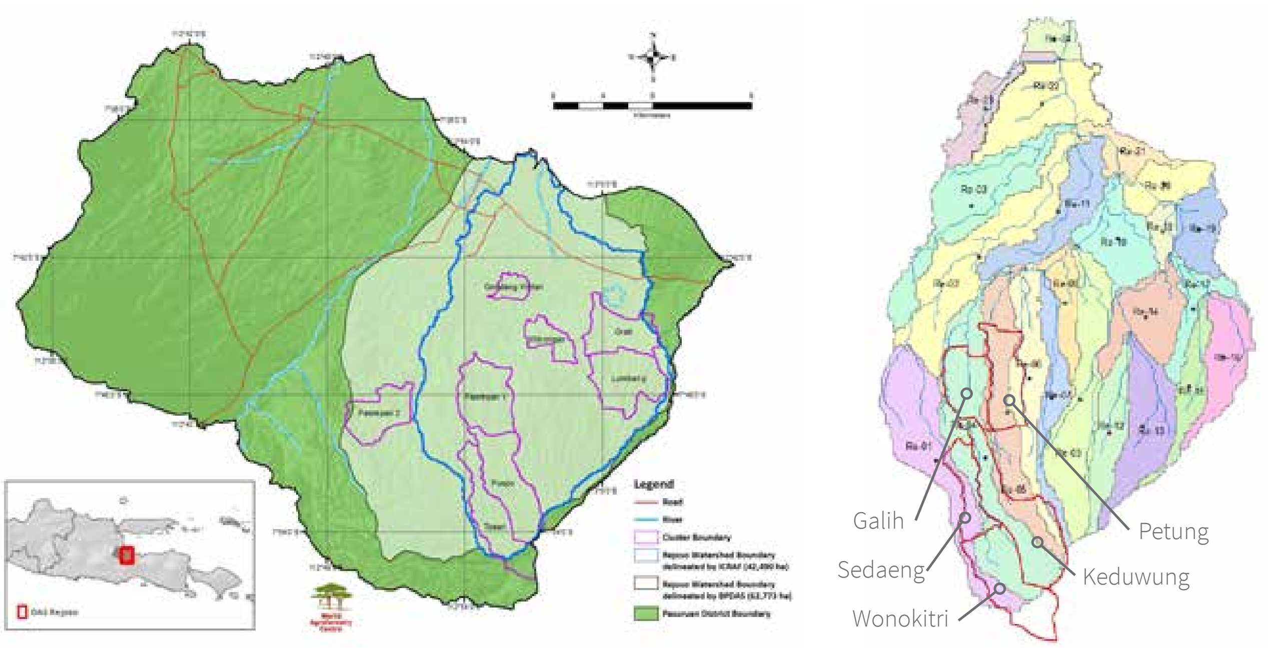



Figure 11: Cluster, watershed and sub-watershed boundary

[2] van Noordwijk M, Widodo RH, Farida A, Suyamto DA, Lusiana B, Tanika L, Khasanah N. 2011. *GenRiver and FlowPer: Generic River Flow Persistence Models.* User Manual Version 2.0. Bogor, Indonesia: World Agroforestry Centre.

Table 12: Scenario of tree cover increments in horticulture and agroforestry systems in 2015-2033

| Land cover | 2015 | 2023 | 2028 | 2033 |
|---|---|---|---|---|
| Horticulture | Land cover at year 2015 | Increasing tree density on 30% area of horticulture | Increasing tree density on 60% area of horticulture | Increasing tree density on 100% area of horticulture |
| Agroforestry | Land cover at year 2015 | Increasing tree density on 30% area of agroforestry* | Increasing tree density on 60% area of agroforestry* | Increasing tree density on 100% area of agroforestry* |

Note: *Sengon agroforests and complex agroforests with assumption the amount of rainfall is the same from year to year.

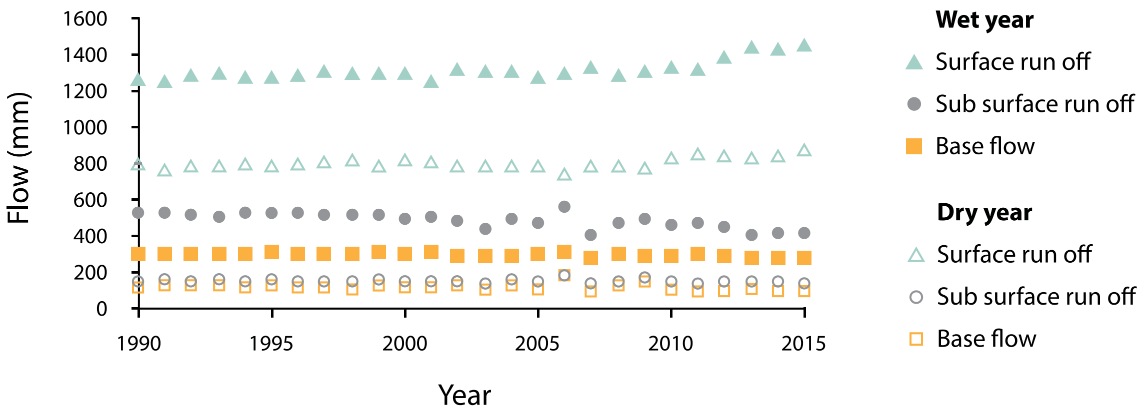
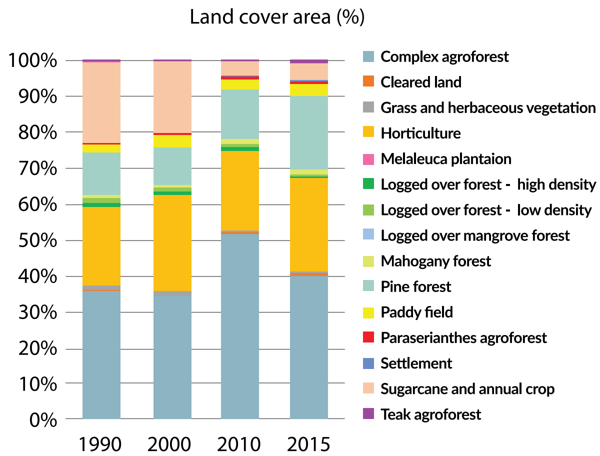
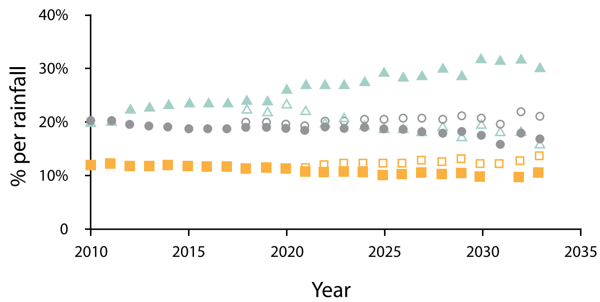



Figure 12: Historical changes of surface flow, sub-surface flow and base-flow at watershed level

## Sub watershed Re01

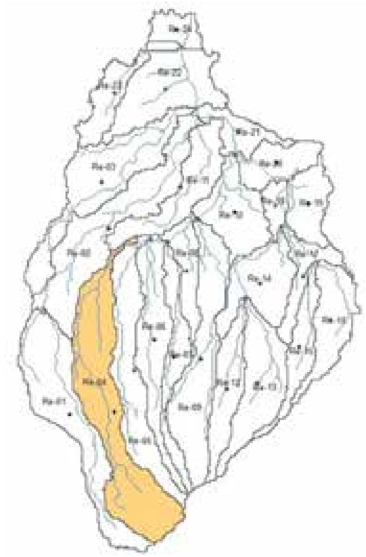


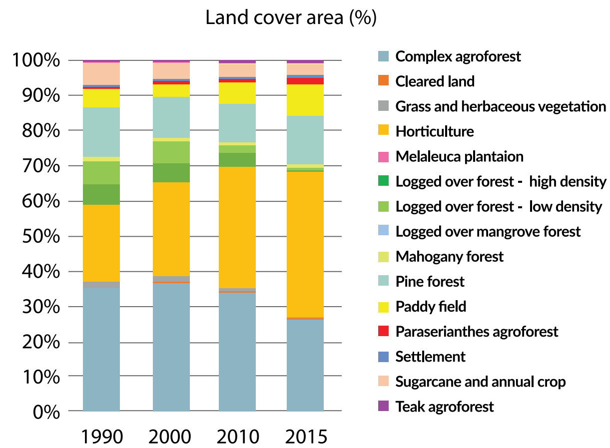




| | hectare | |
|---|---|---|
| Total sub-watershed Re-01 | 3008 | 100% |
| Agroforestry | 1209 | 41% |
| Horticulture | 781 | 26% |

| Scenario of 500 hectare tree planting | |
|---|---|
| Decreased surface run-off | 1.5% |
| Increased of infiltration | 0.5% |

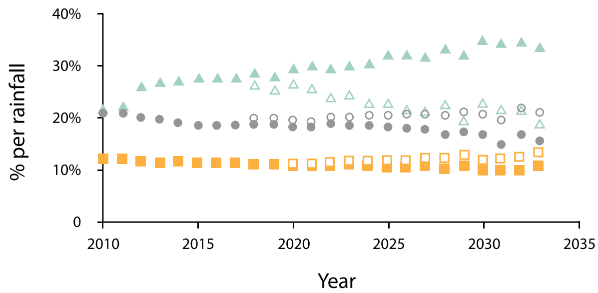
## Sub watershed Re04



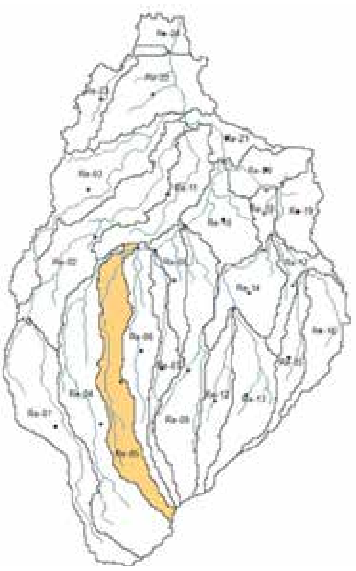


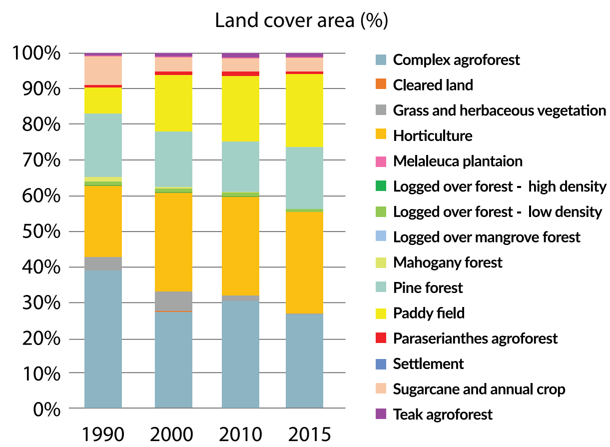

| | hectare | |
|---|---|---|
| Total sub-watershed Re-01 | 3996 | 100% |
| Agroforestry | 1097 | 25% |
| Horticulture | 1648 | 41% |

| Scenario of 500 hectare tree planting | |
|---|---|
| Decreased surface run-off | 1.5% |
| Increased of infiltration | 0.5% |



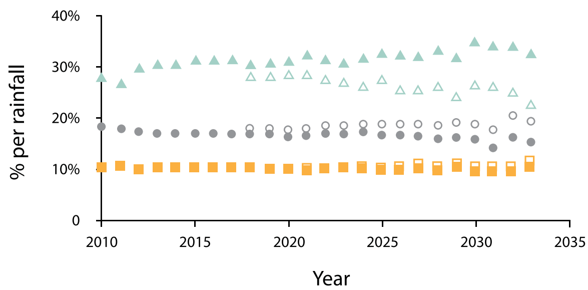

## Sub watershed Re05



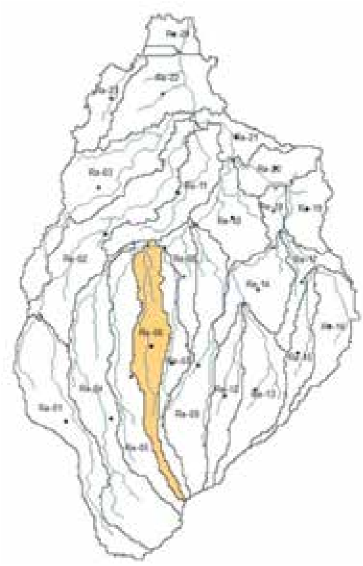


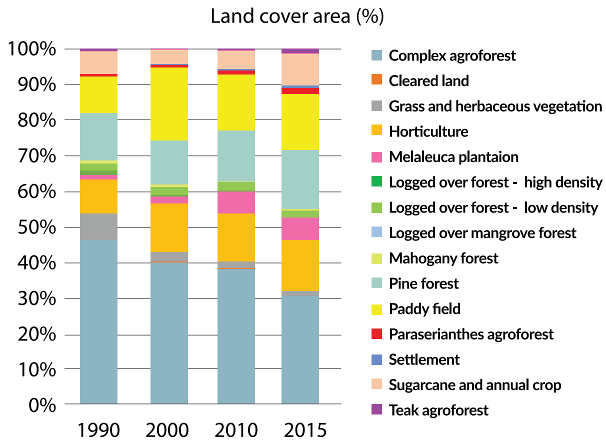

| | hectare | |
|---|---|---|
| Total sub-watershed Re-01 | 2405 | 100% |
| Agroforestry | 652 | 28% |
| Horticulture | 690 | 29% |

| Scenario of 500 hectare tree planting | |
|---|---|
| Decreased surface run-off | 2% |
| Increased of infiltration | 1% |



## Sub watershed Re06






| | hectare | |
|---|---|---|
| Total sub-watershed Re-01 | 1919 | 100% |
| Agroforestry | 606 | 29% |
| Horticulture | 272 | 14% |

| Scenario of 500 hectare tree planting | |
|---|---|
| Decreased surface run-off | 2% |
| Increased of infiltration | 1% |

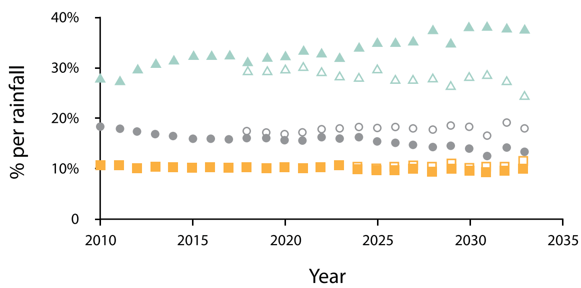



Figure 13: Prediction of surface flow, sub-surface flow and base flow of with and without PES scheme at four sub-watersheds

## 5.6 Benefit from watershed conservation to smallholders

Horticultural and agroforestry practice are the two most important farming systems in upstream and midstream Rejoso. Using the available secondary data, achieving a revenue increment is feasible for smallholders who practise conservation techniques in both farming systems. Table 13 estimates the increase of revenue for potato and durian agroforestry farmers when they apply sediment-reduction techniques on their farms. In the long term, by applying water and soil conservation techniques, farm productivity will likely increase owing to improved soil fertility.

Table 13: Revenue increment for farmers implementing conservation practices

| Systems | Revenue increment*(Rp/ha/year) |
|---|---|
| Potato** | 11,461,000 |
| Durian | 6,789,000 |

Note: *average over 30 years projection; **calculated based on 2 seasons of potato per year.

# Live on farm: a mosaic of production landscape in Tosari

Photo: World Agroforestry Centre/Ni'matul Khasanah

# 06 Monitoring and evaluation of on-the-ground results

Monitoring and evaluation of conservation and livelihoods' programmes are fundamental for the project implementer and corporation to understand ground realities, learn from past experience, improve the delivery system of programme activities, design future systematic planning and resource allocation and, most importantly, measure results as part of accountability to key stakeholders.

In the case of payment for ecosystem services programmes, the monitoring activity has a specific purpose of measuring the performance of participating farmers as the basis for their payment disbursement. In Rejoso Kita, the contract states aspects of monitoring, including a timeline and payment modalities. Field monitoring will involve representatives from NGO, corporate, village office, and other local government authorities to ensure its transparency and fairness.

Table 14 recommends three criteria for monitoring and evaluation: 1) quantifiable ecological performance from conservation activities; 2) social cohesion and female inclusion through local communities' capacity strengthening; and 3) financial benefits from joining conservation–livelihoods' programmes under the Rejoso Kita initiatives. The ecological performance monitoring has to be carried out at both plot (i.e. farmers' land) and sub-watershed (i.e. riparian, river body) scales. The World Agroforestry Centre has published a series of monitoring and evaluation tools for field measurement of ecosystem services.

Table 14: Criteria and indicators for monitoring and evaluating the payment for ecosystem services programme in Rejoso Watershed

| Criteria | Indicators | Parameters |
|---|---|---|
| Ecological | Tree density | Increasing tree density (at least 300 trees per hectare for horticulture fields and 500 trees per hectare for agroforestry systems) |
| | Canopy density | Increasing tree canopy density* |
| | Litter thickness | Increasing litter thickness * |
| | Sedimentation rate | Decreasing sedimentation rate* |
| | Run-off rate | Decreasing run-off rate* |
| | Infiltration rate | Increasing infiltration rate* |
| Social | | |
| Social cohesion and participation | Number of group meetings | At least once per month<br>> 80 % group members join each meeting |
| | Workplan implementation | % of activities in the work plan that have been undertaken on schedule (e.g. tree planting, sediment trap construction) |
| | Participation in conservation activities | Number of participants who continue to carry out conservation activities post-contract<br>Number of non-participating farmers who replicate conservation activities from the PES programme |
| Gender equity | Women involvement | Perceived benefits for women |
| Knowledge & Awareness | | Perceived awareness to conserve the environment with or without the programme<br>Perceived knowledge of the importance of environmental conservation |
| Financial | | |
| Financial benefits for the local community | Income | % change in households' incomes before and after the programme* |
| | Business diversification | Number of new business options, e.g. small- and medium-scale enterprises, stimulated by the PES programme* |
| | Benefit sharing (payment utilization) | % of payment/incentives used for productive activities (e.g. education; health; communal facilities; business; personal savings; household expenses) |
| Public financing for expanding the scale of activities | Village fund utilization | Village fund is allocated to support conservation activities |

Note: *from the baseline level as measured in the beginning of contract

# 07 Roadmap

Rejoso Kita has pioneered a comprehensive scientific scoping and pilot of payment for ecosystem services scheme. To achieve the sustainability goals of protecting and restoring the critical Rejoso watershed and simultaneously improving local welfare, future steps are essential to ensure the continuous and permanent impact of the programme and increase the likelihood of self-replication and wider adoption.

A road map has been created that sets out the proposed future steps required by the Rejoso Kita initiative after the scoping and piloting period in the upstream and midstream. Operating under the assumption that the Water Alliance will coordinate the implementation of the road map, more systematic and effective interventions in the downstream will be indispensable to achieve water resource sustainability, water security and business continuity for Rejoso residents and surroundings. In short, the road map recommends four actionable strategies.

- **Upstream and midstream:** operational and sustainable payment for ecosystem services schemes for increasing watershed infiltration capacity and reducing sedimentation rates
- **Downstream:** water resource engineering for increased efficiency and security
- **Downstream:** climate-smart paddy rice cultivation (water efficient and low emission
- **Cross-cutting livelihood options:** upstream, midstream and downstream

Table 15: A road map for future co-investment in Rejoso watershed

| P | **Upstream and midstream**<br>Operational and sustainable payment for ecosystem services schemes for increasing watershed infiltration capacity and reducing sedimentation rates | | | | |
|---|---|---|---|---|---|
| | **Component** | **Target** | **Year 1** | **Year 2** | **Year 3** |
| P1 | Payment for ecosystem services contract management (including payment disbursements) | Timely payment disbursement<br>Management quality of facilitation | | | |
| P2 | Participatory monitoring of infiltration and sedimentation rates | Frequency of monitoring<br>Data quality | | | |
| P3 | Engagement other investors to the payment for ecosystem services (PES) schemes | Number of investors<br>Investment amount | | | |
| P4 | Replication and upscaling PES schemes | Number of PES areas<br>Number of farmer groups | | | |

| E | **Downstream:** water resource engineering for increased efficiency and water security | | | | |
|---|---|---|---|---|---|
| | **Component** | **Target** | **Year 1** | **Year 2** | **Year 3** |
| E1 | Awareness raising water-use efficiency | Number of trainings<br>Number of participants (male/female) | | | |
| E2 | Common visioning and participatory process in designing potential interventions and governance on water resource engineering plans (i.e. lowering water demand, valve installations and well closing, others) | Collective agreement from community | | | |
| E3 | Capacity building to maintain, build water resource governance system and monitor performances (technically and socially) | Number of trainings<br>Technical guidelines for implementation | | | |
| E4 | Collective actions in constructing the installed water resource engineering | Number of constructions<br>Quality of constructions | | | |
| E5 | Community monitoring on water-use efficiency | Monitoring plan (schedule, responsible persons)<br>Frequency of monitoring<br>Data quality | | | |

| C | **Downstream:** climate-smart paddy rice cultivation (water efficient and low emission) | | | | |
|---|---|---|---|---|---|
| | **Component** | **Target** | **Year 1** | **Year 2** | **Year 3** |
| C1 | Awareness raising and visioning on climate-smart agriculture | Agreements on plans | | | |
| C2 | Demo-plots of climate-smart technologies (i.e. intermittent irrigation, chemical fertilizer optimization, suitable rice variety) | Number of demo-plot areas<br>Number of farmer groups | | | |
| C3 | Capacity building on climate-smart agriculture management, post-harvest technology | Number of trainings<br>Number of participants (male/female)<br>Level of adoption | | | |
| C4 | Entrepreneurship facilitation and skill enhancement, including access to market for green products | Income increment | | | |
| C5 | Agriculture carbon and water footprint monitoring | Monitoring plan (schedule, responsible persons)<br>Frequency of monitoring<br>Data quality | | | |

| D | **Cross-cutting livelihood options:** upstream, midstream and downstream | | | | |
|---|---|---|---|---|---|
| | **Component** | **Target** | **Year 1** | **Year 2** | **Year 3** |
| D1 | Agriculture income enhancement from (1) diversifications of commodities; (2) better access to markets; (3) quality improvement. | Income increment<br>Number of business diversification<br>Added-value of products | | | |
| D2 | Demo-plots for 'good agricultural practices' and post-harvest technology for agroforestry products | Number of demo plot area<br>Number of farmers involved<br>Added-value of products<br>Level of adoption (beyond the project timeframe) | | | |
| D3 | Green business options and entrepreneurships, such as biogas, organic products, application of sustainability certification | Business options at community level<br>Revenue from alternative green business | | | |
| D4 | Financial literacy in managing household finance, access to credit and banking systems for females. | Number of trainings<br>Number of female participants<br>Level of adoption (beyond the project timeframe) | | | |
| D5 | Utilisation private and public funds for supporting green businesses | Commitment from partners and investors<br>Number of agreements<br>Investment amount | | | |

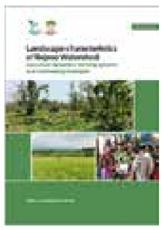
| S | **Cross-cutting programme sustainability:** upstream, midstream and downstream | | | | |
|---|---|---|---|---|---|
| | **Component** | **Target** | **Year 1** | **Year 2** | **Year 3** |
| S1 | Local government engagement and cross-sectoral forum development for supporting overall programme | A cross-sectoral forum<br>Frequency of meetings<br>Number of members | Regularly along the process | | |
| S2 | Business-sector engagement for replicating and upscaling the sustainability initiatives | Number of investors<br>Investment amount | | | |

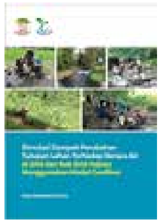
# Plants trees to benefit future generation

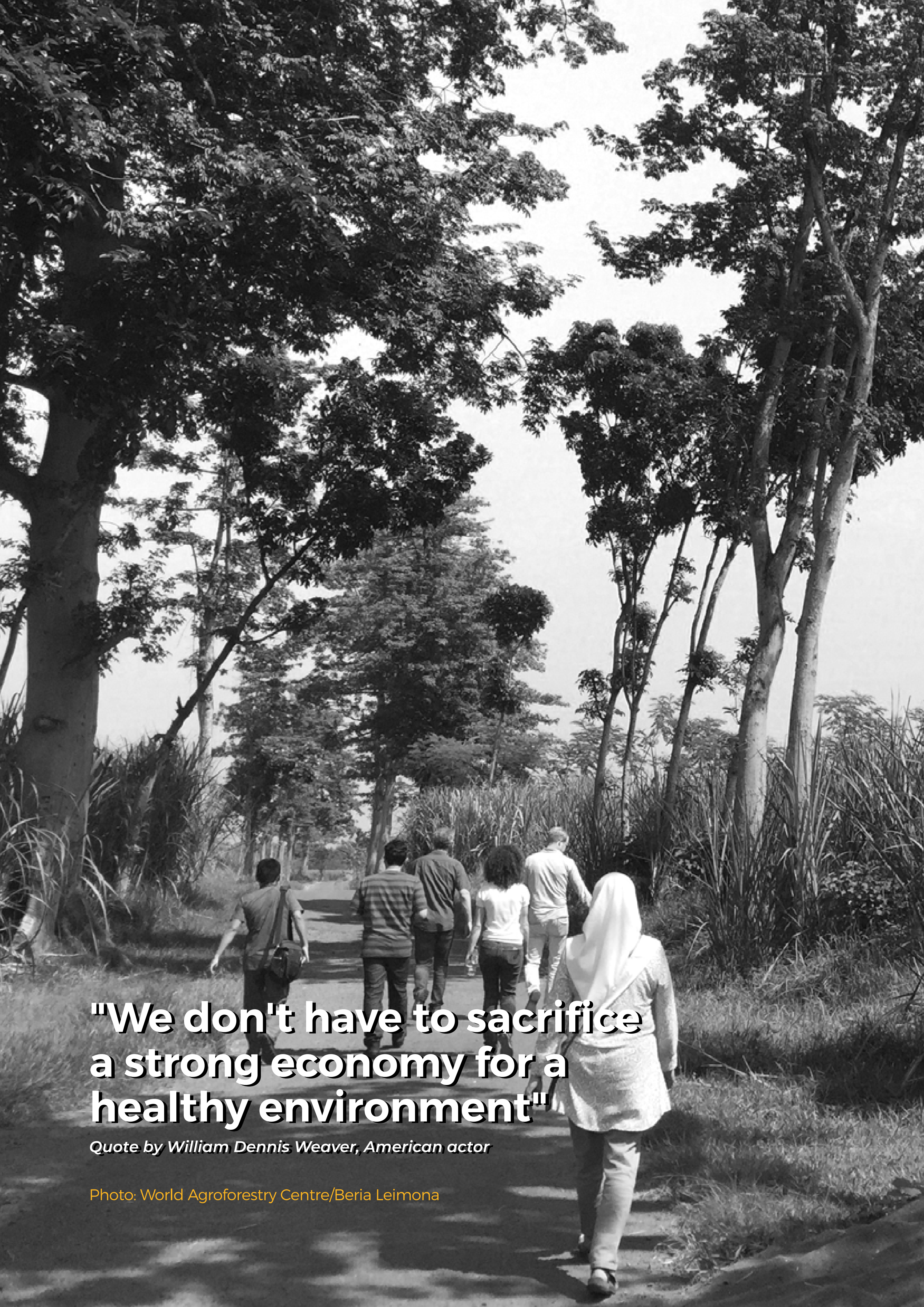
Photo: World Agroforestry Centre/Sidiq Pambudi

# 08 Appendices

The table below provides the publication outputs from various project components coordinated by the World Agroforestry Centre for the Rejoso Kita project.

| Project component | Publication Output | |
|---|---|---|
| **Component 1. Participatory landscape assessment/diagnosis for appraising the context**<br>K1.0. Site Cluster Selection<br>K1.1. Farmer Focus Group Discussion (FGD) on land use and landscape functioning (land-use change, farming system, SERI, hydrology, and land utility) | Report: Amaruzaman S, Khasanah N, Tanika L, Dwiyanti E, Lusiana B, Leimona B, Janudianto. 2017. Perubahan Guna Lahan dan Karakteristik Kerentanan Masyarakat di DAS Rejoso. Report. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.<br>http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4127 |  |
| **Component 2. Analysis of land-use and –cover trajectory as the basis for appraising watershed functions and services**<br>K2.1.Analysis of land-use and –cover trajectory as the basis for appraising watershed functions and services. | Poster: Khasanah N, Leimona B, Khususiyah N, Amaruzaman S, Tanika L, Lusiana B. 2017. Karakteristik dan potensi skema pembayaran jasa lingkungan wilayah tengah DAS Rejoso. Poster. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.<br>http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4199 |  |
| **Component 3. Assessment of land-use practices, systems and technology**<br>K3.1.Understanding the common existing land-use practices, systems and technologies (particularly related to soil and water conservation)<br>SK3.1.1. FGD (CaSAVA farming system and hydrology)<br>SK3.1.2. Household Survey | Poster: Khasanah N, Leimona B, Khususiyah N, Amaruzaman S, Tanika L, Lusiana B. 2017. Karakteristik dan potensi skema pembayaran jasa lingkungan wilayah hulu DAS Rejoso. Poster. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.<br>http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4198 |  |
| **Component 4. Analysis of land-use profitability**<br>K4.1. Compiling secondary data on commodity production figures<br>K4.2. Collecting data on macro-economic of commodities input (labours, tradable purchased inputs, etc.) and output quantities, and prices at 'farm-gate' | Report: Hendratmo. 2017. Analisa Profitabilitas Dan Rantai Nilai Untuk Komoditas Unggulan Di Kabupaten Pasuruan - Komoditas Kopi, Mangga, Durian, Dan Sengon. Report. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. | |
| **Component 5. Gender-sensitive local knowledge gathering to reduce vulnerability and increase adaptive capacities to climate change and other shocks.**<br>K5.1. Assessing the vulnerability of local communities to risks related to climate variability and extremes at the sites<br>SK5.1.1. FGD CaSAVA and SERI<br>SK5.1.2. Key Informant Interview (KII)<br>SK5.1.3. Household survey | RP00321-17<br>Report: Amaruzaman S, Khasanah N, Tanika L, Lusiana B, Leimona B, Khususiyah N. 2017. Kekuatan, kelemahan, peluang dan ancaman masyarakat di DAS Rejoso: Profil site penelitian proyek Rejoso Kita di DAS Rejoso, Pasuruan. Report. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.<br>http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4190 |  |
| K5.2. Identifying (climate-smart agriculture) options to increase resilience and adaptive capacities to climate change | Report: Amaruzaman S, Khasanah N, Tanika L, Dwiyanti E, Lusiana B, Leimona B, Janudianto. 2018. Landscape characteristics of Rejoso Watershed: land cover dynamics, farming systems and community strategies. Report. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.<br>http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4284 |  |

| Project component | Publication Output | |
|---|---|---|
| **Component 6. Assessment of ecosystem services: watershed problems, functions and services (water quantity, quality), and efficient-use of water.** | Working paper: Damayanti VD, Nailufar B, Putra PT, Syahadat RM, Alfian R, Leimona B. 2017. Analisis Tapak Mata Air Umbulan, Pasuruan, Jawa Timur. Kajian elemen biofisik dan persepsi masyarakat. Working Paper 262. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. DOI: 10.5716/WP17147.PDF. http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4196 |  |
| K6.1. Primary and secondary data collection | | |
| K6.2. Developing hydrological modelling on various land use options and landscape water balance - GenRiver Modelling | | |
| K6.3. Exploring local knowledge of communities and policy makers on ecosystem functions and services, consequences of different land use options in the landscape, problems of excessive water extractions, including community drilling and wells - RHA | Report: Tanika L, Khasanah N, Leimona B. 2017. Pengaruh Perubahan Tutupan Lahan Terhadap Neraca Air DAS Rejoso, Pasuruan, Jawa Timur, menggunakan model GenRiver. Report. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4283 |  |
| | Report: Suprayogo D, Widianto, Saputra D, Sari RR, Maulana R, Sutanto TD, Hairiah K. 2018. Sistem Penggunaan Lahan "Ramah Infiltrasi" di DAS Rejoso Jawa Timur. Universitas Brawijaya. Malang. Report. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. | |
| **Component 7. Potential business case for ecosystem services provision and livelihood improvement, technical support for implementing partners (i.e. SII for local actions and CK-Net for district actions) to develop workplans and key activities, and a guidelines for monitoring and evaluation.** | Report: Leimona B, Khasanah N, Tanika L, Hidayat, Pambudi S. 2018. Model Ko-Investasi dan Pembayaran Jasa Lingkungan di DAS Rejoso, Pasuruan. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. |  |
| K7.1. Development of business case | Article: Ekadinata A, Perdana A, Leimona B, Lusiana B, Purnamasari E, Martini E, Negoro FS, Hairiah K, Tanika L, van Noordwijk M, Khasanah N, Khususiyah N, Finlayson R, Amaruzaman S, Dewi S, Suyanto. 2017. Kiprah Agroforestri - Agustus 2017. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4212 | |
| K7.2. Development of Guideline for monitoring and evaluation | | |
| K7.3. Support the development of workplan & activities for SII and CK-Net | | |
| K7.4. Technical Assistance for activity monitoring and evaluation | Poster: Leimona B, Khasanah N, Khususiyah N, Amaruzaman S, Tanika L, Lusiana B. 2017. Pembayaran Jasa Lingkungan: investasi bersama untuk konservasi DAS berbasis kinerja. Poster. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. http://www.worldagroforestry.org/region/sea/publications/detail?pubID=4197 |  |



**"We don't have to sacrifice a strong economy for a healthy environment"**

***Quote by William Dennis Weaver, American actor***

Photo: World Agroforestry Centre/Beria Leimona

The Rejoso business case is based on information from piloting a payment for ecosystem services (PES) scheme aimed at stimulating multi-stakeholder co-investment in restoring and maintaining good watershed functions. It presents the benefits of applying innovations in setting the PES pilot that enhance participation and inclusiveness of smallholder farmers in the programme, link the scientific approaches to on-the-ground actions and, ultimately, ensure that the programme is cost-efficient and effective in restoring and maintaining watershed functions compared to 'business as usual'; and covers the upstream and midstream pilots of Rejoso watershed, the first phase of the Rejoso Kita initiative implemented by a consortium coordinated by Social Investment Indonesia Foundation, World Agroforestry Centre (ICRAF), Collaborative Knowledge Network (CK-Net), TNC and partners supported by the Danone Ecosystem Fund. At the end of this document, a 'roadmap' presents four follow up strategies, which cover further interventions in the downstream of Rejoso to guarantee comprehensive and integrated watershed and water resource management that simultaneously enhances local welfare and stimulates a change of behaviour to reduce the local water footprint.