Analysis of the Adoption of Willow Growing Practice in Latvia

EVISA ĀBOLIŅA[1]*, VALERIE A. LUZADIS[2] AND DAGNIJA LAZDIŅA[3]

[1, 2] The Departments of Forest and Natural Resources Management and the Environmental Studies, State University of New York, College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY 13210-2787, USA; eabolina@syr.edu; vluzadis@esf.edu.

[3] Latvian State Forest Research Institute "Silava", Rigas iela 111, LV-2169, Salaspils, Latvia

Āboliņa, E., Luzadis, V.A. and Lazdiņa, D. 2014. Analysis of the Adoption of Willow Growing Practice in Latvia. *Baltic Fores*try 20(1): 78–87.

Abstract

Willow growing was first introduced to Latvian farmers in the mid-1990s as an alternative source of bioenergy to complement conventional practices of farming and forestry. Willow growing, however, remains a fairly uncommon practice in Latvia. In 2012 the total area of willow plantations constituted only 261 ha. The theory of diffusion of innovations was applied to study the characteristics and decision making process of willow growers in Latvia. In-depth interviews were used to learn about their experiences, communication channels and methods of adoption. The results suggest that the willow growers in Latvia could be characterized as 'innovators' and/or 'early adopters'. All of the respondents regarded willow as a great opportunity for utilization of agricultural lands, especially in the areas not well suited for food production. The results show that while some of the farmers were willing to proceed with the adoption of willow practice, they faced certain obstacles and uncertainties making their decision on adoption difficult, such as ineffective weed control measures, lack of profitability and inadequate subsidy programs for SRWC. All of the respondents suggested they would prefer to wait another three to four years before they decide on the adoption or continuation of willow practice. The results also suggest lack of established communication networks between the willow growers in Latvia. The study proposes several areas for improvement to increase the rate of adoption of short rotation woody crop (SRWC) practice in Latvia.

Key words: short rotation woody crops (SRWC), willow, farmers, innovation adoption, qualitative methods, Latvia.

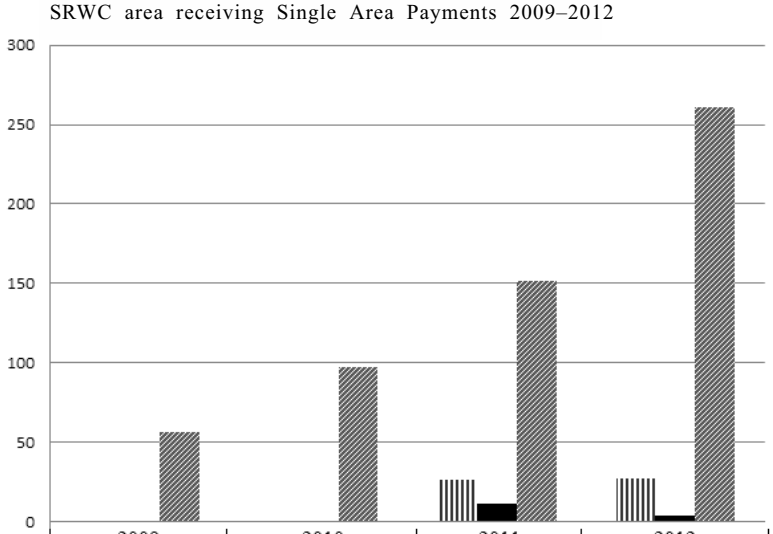
Introduction

Latvia, among many other European Union (EU) member states, is testing its potential to meet the renewable energy targets of 2020 and has committed to increase its domestic renewable energy share to 40% by 2020 (EC 2009, ME 2012). To produce bioenergy domestically in a sustainable manner, Latvia will need bioenergy crops with high energy content which could also avoid land use conflicts related food production and conservation (Fritsche et al. 2010). Second-generation biofuels, such as willow are proven to have higher energy potential when compared to annual food crops, and are better suited for lower quality agricultural areas that do not compete with food production (e.g. lands high in fertility) or conservation objectives (e.g. lands high in biodiversity) (Börjesson 1996, Eisentraut 2010). Short rotation woody crops (SRWC) are also regarded as an alternative source of carbon neutral energy production (Volk et al. 2004). A great variety of lignocellulosic crops and consistent annual feed stock availability makes woody biomass a promising renewable energy resource (Volk et al. 2004). Favourable characteristics and feed stock conditions have directed the interest towards woody biomass crop production for bioenergy purposes also in Latvia. SRWC, such as short rotation willow (*Salix* spp.), aspen (*Populus* spp.), grey alder (*Alnus incana*) and black alder (*Alnus glutinosa)* have been recognized to be well suited for Latvia's climate and geographic conditions (Lazdina et al. 2007). Studies in Sweden (Rosenqvist et al. 2000), Poland (Ericsson et al. 2006) and United States (Volk et al. 2004) suggest SRWC as a successful alternative practice having multiple social and ecological benefits, and economic potential. Renewable energy, such as second-generation biofuels, when produced in a sustainable manner could bring substantial benefits at regional and local levels, including carbon neutral energy production and new employment opportunities to revitalize rural economies.

Despite the success of SRWC establishments in Europe, North America and elsewhere in the world, SRWC production remains a fairly new and uncommon practice in Latvia. Willow growing was first introduced to Latvian farmers in the mid-1990's as an alternative source for bioenergy to complement existing practic-

es of farming and forestry (LSFRI Silava). In 2009, land owners in Latvia for the first time received Single Area Payments (SAP) for the management of SRWC, in particularly, willow (*Salix spp.*) (RSS). As of 2010, they could also receive SAP for cultivation of short rotational aspen (*Populus spp*.) and white alder (*Alnus incana*) with a maximum rotational period of 5 years (CM No.139, 2013). SAP payments, however, are available only for agricultural territories which do not contain existing or newly established amelioration systems (CM No.139, 2013). Figure 1 summarizes the dynamics of SRWC practices in Latvia since 2009, while Figure 2 shows the spatial distribution of SRWC plantations in 2012. A total number of willow growers in 2012 was 62 of which 42 had more than 1 ha of willow (LSFRI Silava; RSS).

In 2010 and 2011, from 13 to 16 % (312,000–369,000 ha) of agricultural land was classified as abandoned (RSS). Of which 261,710 ha are estimated as geographically suitable for SRWC production and could be utilized to produce second generation biofuels (Abolina 2013). Utilization of these agricultural lands with SRWC



	2009		2010		2011		2012	
	ha	growers	ha	growers	ha	growers	ha	growers
Willow (*Salix* spp.)	56.3	5	96.81	28	151.51	49	260.65	62
Grey alder (*Alnus incana*)			0.31	2	11.22	11	3.35	5
Aspen (*Populus* spp.)			0.53	3	26.22	10	26.64	10

Figure 1. Short rotation woody crop areas receiving Single Area Payments from 2009 to 2012 (LSFRI Silava; RSS)

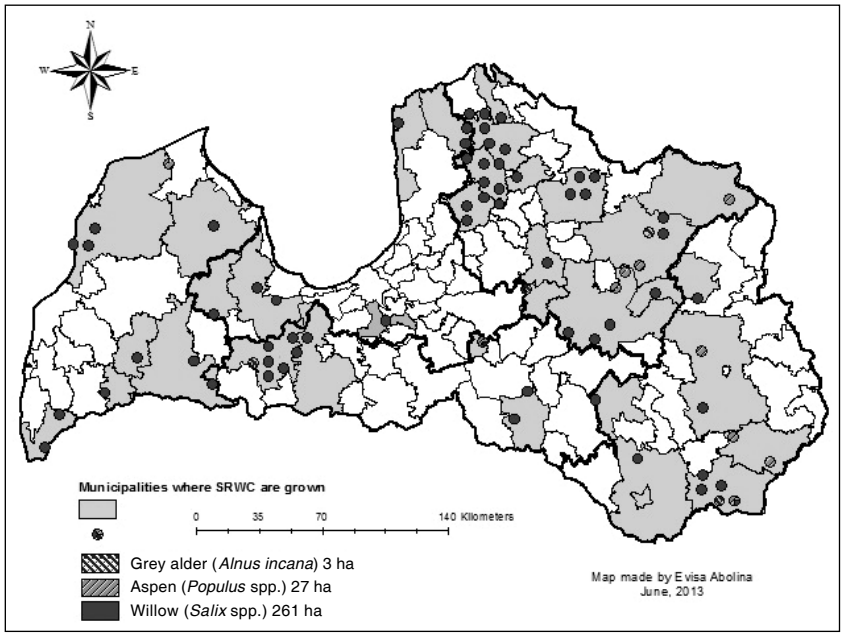


Figure 2. Spatial distribution and total amount (ha) of SRWC grown in Latvia in 2012 (RSS; LSFRI Silava; ESRI)

practices, however, remains fairly uncommon among land managers in Latvia. These and other considerations have raised questions as to why SRWC production has not become an alternative choice of production among farmers and foresters in Latvia and what can be done to foster the adoption of SRWC practice.

The objective of this study was to better understand the various factors that help or hinder the adoption of SRWC practices in Latvia learning through experiences of the willow growers. The theory of diffusion of innovations was applied as a conceptual framework to study the decision-making process of willow growing practices in Latvia, including the factors that lead to the adoption or rejection of the new practice (Rogers 1995). Inter alia, this study also looks at the characteristics of farmers who have decided to grow willow on their farms, including their motivation, experience and ways of communication to better understand and implement the practice.

Theoretical framework

A theoretical framework of innovation decision process developed by Rogers consists of five major components of the decision making stages (Rogers 1995): (1) *The knowledge stage* –the initial stage during which the individual becomes aware of an innovation and seeks information that improves his or her knowledge and understanding of an innovation. Inter alia, the knowledge stage involves certain characteristics that help to better determine which factors may or may not influence the individual's perceptions towards an innovation. For instance, prior conditions, such as previous practice(s), needs and problems, innovativeness and social norms, might shape the individual's perceptions about the innovation. Socio-economic characteristics (e.g. age, formal education and social status), personality variables and communication behavior are factors that could contribute to individual's knowledge and their ability to learn and understand the innovation; (2) *The persuasion stage* when the individual is more actively seeking an evaluation of the information about the innovation and forms an attitude towards the innovation. At the persuasion stage the individual considers the relative advantages or disadvantages, compatibility and complexity of the innovation. At this stage the individual also evaluates his or her own ability to try and observe the innovation; (3) *The decision stage* described as a more active stage, at which the individual might decide to try the innovation on a small-scale basis. At the decision stage the individual decides whether to adopt or to reject the innovation; (4) *The implementation stage* when the individual puts the innovation into practice. It might be followed by re-invention, which suggests that in some cases the individual might 'adjust' the innovation to his or her own needs, and thus also to improve the innovation; (5) At the final, *confirmation stage*, the individual evaluates, whether the decision to adopt the innovation was the best decision. Rogers suggests that, even though at this stage the individual has already adopted the innovation, s/he may as well reverse the decision if their experience or information about the innovation conflicts with the individual's needs and expectations (Rogers 1995).

The diffusion theory also suggest five categories of individuals, called 'adopters', and their characteristics: (1) innovators; (2) early adopters; (3) early majority, (4) late majority, and (5) laggards (Rogers 1995). Rogers characterizes *innovators* as 'venturesome' and almost obsessed with innovations, being able to cope with high degree of uncertainty and are, typically, prone to risk and are more independent in their actions and decisions (Rogers 1995). According to Rogers, *early adopters* are regarded as opinion leaders with certain status and respect in the society, and hold stronger bond with local norms and customs (Rogers1995). *The early majority* is characterized as deliberate members of society, interacting with other – more experienced members of society, prior their decision to adopt the innovation (Rogers 1995). For *the late majority*, however, the adoption of an innovation might come by force, either by social, economic or other pressures (Rogers 1995). *Laggards* are characterized as more conservative and cautious members of society, for whom the adoption of innovation might be either economically challenging, socially unacceptable or constitute other reasons for resistance towards an innovation (Rogers 1995). According to Rogers, less than 5% of the adopters are truly innovators (Rogers 1995). A slightly higher number (around 14%) tend to be the *early adopters*, with the majority of 34% individuals being either *early majority* or *late majority* of adopters (Rogers 1995). *Laggards* typically constitute a fairly small percentage (16%) of the total population of potential adopters (Rogers 1995).

While the Diffusion of Innovation theory has received some criticism (e.g. Ruttan 1996, Ohlmer et al. 1998, Aikens 1974) the proposed innovation-decision model by Rogers, nevertheless, still provides a powerful analytical framework to study the process of adoption of an innovation, and allows for a better understanding of the possible factors which may or may not influence the adoption of an innovation or innovative practice. Therefore, the innovation-decision framework was regarded as a useful tool to explore the adoption process of SRWC practices among farmers in Latvia.

Materials and Methods

The study was conducted in Latvia during the summer of 2012. A series of in-depth semi-structured face to face interviews along with field observations were carried out with farmers who have decided to grow willow on their farms. The respondents were selected based on the information and data provided by the Latvia's Rural Support Service (RSS) and the Latvian State Forest Research Institute "Silava" (LSFRI Silava) on agricultural areas receiving SAP in 2009, 2010 and 2011 for the establishment of SRWC. Based on a greater proportion of individuals engaged in willow (*Salix* spp.) growing practices rather than aspen (*Populus* spp.) and grey alder (*Alnus incana*) (Figure 4-1), the decision was taken to approach willow growers who have at least 2 years of willow growing experience and have a minimum of 1 ha of willow planted. The RSS records revealed that in 2011 there were a total of 49 willow growers in Latvia in, of which 17 had more than 1 ha of willow and 2 years of willow growing experience (RSS).

The respondents were recruited over the phone. During the recruitment process farmers were introduced to the research project, and were asked if they would be willing to share their experiences on willow growing practices. Out of 17 willow growers eight agreed to meet up for an interview. Some reasons behind willow grower inability to meet for an interview were: (1) logistics and conflicting time schedules between the farmer and the research team (three respondents with trials from 1 to 3 ha); (2) failed practices i.e. willow did not root (one respondent with 1 ha large trial); and (3) discontinuation of the practice due to low profitability (five respondents with 1 ha large trials). All of the nine respondents who were unable to meet stated their trials in 2009 (RSS). Interviews typically lasted 30 – 40 minutes. The willow growers were asked to: (1) share their stories on how they first came to hear about the SRWC and the willow growing practice, including their initial communication channels; (2) indicate their motivations and main reasons for starting a willow growing practice; (3) share their opinions on the willow growing experience; (4) indicate how long it took them to decide to adopt (or reject) the practice; and (5) confirm whether they have completely decided to continue growing willow, including the main reasons behind their decision. Some of the demographic questions, such as the respondent's education, age, occupation, social status (i.e. their position or role at the organization or household), prior experiences, total amount of land under their supervision and total amount of willow planted were also recorded during the interview. All of the respondents were keen on showing their operations while being interviewed. These research observations constituted part of the interview process and were incorporated into the overall assessment to provide additional information necessary to complete the analysis under the theoretical framework.

Statement of research ethics. Determination of an exemption from regulations issued by the Syracuse University Institutional Review Board (SU IRB) was obtained in order to carry out the recruitment and the interviews. An informed consent, approved by SU IRB to guarantee the anonymity and personal data protection of the respondents, was read to all the respondents and their written consent was obtained prior the interview. A copy of informed consent was given to each participant for their own records.

Data analysis. The interview records were transcribed, coded and analyzed following the standard thematic approach of qualitative data analysis (Saldana 2009). Interview transcription, coding, analysis and translation were done by the principal investigator. Attribute coding was used for the demographic and socioeconomic variables, such as age, gender, education, occupation, social status, total land area under management and total area planted with SRWC. An Innovation-Decision framework was used to sort out the answers and to analyze responses according to the five categories of decision making. The five categories of adopters and their characteristics, suggested by Rogers were used as a framework to identify the types of respondents who are growing willow on their farms (Rogers 1995).

Results

A total of eight in-depth interviews along with field observations were carried out with willow growers in Latvia. The respondents represented different parts of the country (i.e. Dobele, Jēkabpils, Jūrkalne, Līvāni, Rucava, Suntaži, Tukums and Valmiera) (Figure 3).

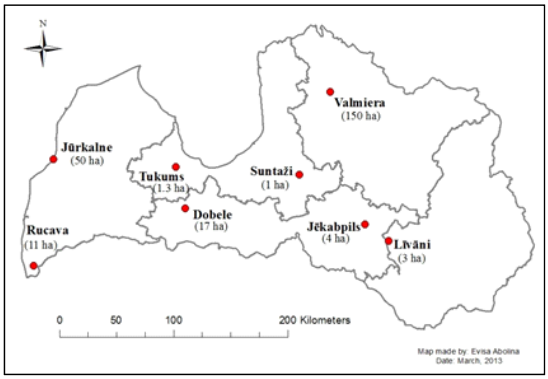


Figure 3. Geographic location of the respondents and total amount of willow planted in 2012 in Latvia (ESRI)

Socioeconomic status, prior conditions and characteristics of the respondents. All of the respondents that were interviewed were male between 26 and 67 years old (age average 43), and were either managers or heads of household. Out of eight respondents, five had previous experience and education in either forestry or agriculture. Of which, three had more than 10 years of experience in farming or forestry, while the remaining two had 4 and 7 years of prior experience. Three of the respondents had no prior practice or education related to forestry of agriculture, and came from different backgrounds, such as publishing business, economics and finance, and IT and engineering. Interestingly, one of the respondents who had no previous experience or education in either agriculture or forestry had 16 years of willow growing practice (i.e. since 1997).

Socio-economic conditions varied greatly among all of the respondents. The total amount of land under their supervision varied from 20 to 5,000 ha in total. Two of the respondents had more than 2,000 ha and the other two from 400 to 450 ha of land under their management. The other four respondents had less than 100 ha of land under their supervision.

A total amount of land planted with willow was from 1 ha to 150 ha (Figure 4?2). Three of the farmers had inherited some part of their lands while four of them had purchased all of their land. Out of all respondents, only one did not own the land and had planted SRWC on rented lands. Out of eight respondents two had invested in advanced equipment designed specifically for SRWC products, such as a wood chip producer, a willow planting machine and a shrub willow harvester. The remaining respondents had basic forestry or farming equipment, such as a tractor for soil preparation, a rototiller for soil aeration and a trimmer for weeding and mowing between the furrows.

All of the respondents shared some common characteristics, such as (1) curiosity; (2) willingness to risk; (3) sense of commitment; and (4) positive attitude and flexibility towards a failure, and were well aware of the risks they were facing, including the investments needed to establish and maintain SRWC, the time required to learn the new practice, and the potential failure and uncertainty about the final result. Five out of eight respondents suggested that their willingness to try SRWC was not directly linked to their previous experiences or education, and was something new they were willing to try and risk giving a chance to. They expressed confidence in undertaking the practice and considered it worth pursuing.

Felt needs and problems. The respondents suggested following reasons for choosing to grow willow: (1) Biophysical and geographic conditions, such as poor quality soils, old and dysfunctional drainage systems, small, fragmented or overgrown parcels that are not well suited for cereal production were among the main reasons to consider alternative solutions and agricultural land utilization with SRWC; (2) looking for alternative sources of energy; (3) market demand to produce willow products, such as fencing, osier, wood chips and/or mulch; (4) searching for crops that would be less sensitive to market fluctuations, when compared to the conventional agricultural crops, such as cereal.

The innovativeness. The earliest trial with SRWC was established in 1996, following another trial in 1997. Two of the respondents set their first trial in 2007 and 2008, respectively. Three of the respondents started growing willow in 2009 and one respondent had his first trial in 2010. This suggests that the majority of the respondents started their willow growing practice relatively late, after 2007.

Out of 8 respondents only two (Rucava and Tukums) have had harvested their willow.

Regarding the acceptance of SRWC among other members of society, farmers were well aware of the concerns and perceptions about willow by individuals not familiar with SRWC practices. The respondents suggested that the majority of people with whom they have been in touch had little to no understanding of SRWC practices. Only one respondent had a positive experience suggesting that lay people perceived willow in a very positive manner. Other respondents, however, suggested that lay people usually perceived willow as something that should rather be weeded out. Such experiences had helped them to become more aware of social concerns and, when applicable, to explain their practice to former land owners and other members of society.

The innovation decision process

The knowledge stage. The respondents became aware of the SRWC practice through different means, such as (1) communication with local and foreign experts who had previously practiced willow growing, including attendance of seminars and exhibitions in Denmark, Lithuania or Sweden; (2) friends and/or acquaintances; (3) mass media and articles (e.g. on-line articles, journals, books and educational booklets – both national and foreign).

The persuasion stage. Forming an attitude and learning about the willow growing practice from personal experience based on a small scale trial was a predominant preference among all of the respondents. After learning about the willow practices from mass media or personal communications, they preferred to set a trial and learn about the advantages and disadvantages of SRWC through personal experience (Ta-

ble 1). Being able to set a small scale trial was the most valuable experience that gave them practical exposure and answers about the pros and cons of SRWC practice including possible solutions. The ability to try and observe was more important to them than the possible failure and disappointment.

determine whether SRWC are a profitable solution. According to the respondents, lands where SRWC are grown should rather be owned, instead of rented, because similarly to forestry it requires long term investments.

(3) *Market and infrastructure*. According to the

Table 1. Summary of willow growing characteristics determining the adoption of the practice.

Characteristics of the practice	Major findings
Relative advantage	(1) The ability to establish willow plantation on agricultural areas less suitable for food production (e.g. less fertile agricultural areas, fragmented, small and remote parcels, previously overgrown lands and former military territories); (2) Compatibility with other farming or forestry practices; (3) Relatively short (3-4 years) time required for growth; (4) Appealing visual characteristics; (5) Versatility of willow products (e.g. live fencing, osier, wood chips, wood pellets, mulch, source of nectar for bees etc.); (6) Higher resistance towards pests and wild animals when compared to aspen (*Populus spp.*) and black alder (*Alnus glutinosa*). (7) Higher Market stability and lower price volatility when compared to the traditional agricultural crops such as cereal; (8) Convertibility – ability to fairly easy reestablish conventional agricultural practices, such as cereal production on former willow plantations.
Compatibility	(1) with other forestry and farming practices and equipment; (2) with other primary jobs unrelated to willow growing.
Level of Complexity	(1) Difficulty with weeding and willow vermin, especially during the first year of establishment; (2) Lack of information on weed and vermin control chemicals and techniques for large scale willow plantations that would be well suited for SRWC in Latvia. (3) Lack of information on effective and inexpensive tactics to protect willow plantations from wild animal invasion (e.g. hare, beaver and deer). (4) Willow responsiveness to the weather irregularities (i.e. tendency to overgrow during mild and moderate winters).
Ability to try	(1) Relatively easy to set a small scale trial (i.e. 0.5 ha to 4 ha) even manually. (2) Easy access and availability of planting material for small trials
Ability to observe	(1) Fairly easy site accessibility. (2) Depending on the stage of the plantation, weekly, monthly or yearly visits of the site are necessary.

The decision stage. Economic considerations were predominant in all of the responses. The majority of the respondents had not yet decided on whether to adopt or to reject the practice and expressed preference to wait another year or two prior making their final decision. According to the respondents, some of the key factors influencing the final decision are:

(1) State support and availability of subsidies. While most of the respondents recognized that it was relatively easy to start and manage willow on a small scale basis, they were certain that they would need to consider investments in SRWC equipment for planting, chemical treatments and harvesting the willow should the scale of production increase. Their decision to invest in the equipment and treatments, however, would depend on the profits, as well as subsidies, loans and/or funds available for SRWC production. Several respondents expressed disappointment with the existing subsidy programs for SRWC in Latvia. The respondents compared the subsidy programs in Latvia to other European Union countries, such as Sweden and Denmark, where willow is grown, and believed that SRWC growers there receive "*three times more*" in subsidy payments when compared to Latvia for the establishment and maintenance of SRWC. They believed it was causing unequal competition and financial difficulties to establish SRWC sites.

(2) *Land availability and cost of production*. Several respondents pointed out that they would need a lot more land if they would decide on adopting the practice. Each of the respondents named different amount (from 60 to 2,000 ha) of land they would need for SRWC to be profitable. The price of land would be one of determinants on whether SRWC production would be more profitable than cereal. One of the respondents suggested that if the land price gets too high it might not be profitable to grow willow anymore. Also, the cost and condition of the rental lands would

respondents, final decision to fully adopt or reject SRWC practice would depend on the market demand and price for wood products. Infrastructure and major facilities of utilization, such as access to points of delivery, boiler houses and co-generation plants are important factors in decision making. Distance of the SRWC plantations from the main facilities corresponds with the cost of delivery, thus also having an impact on the final price and profits. However, lands closer to the facilities and major infrastructure also tend to be more expensive. In that regard productivity, yields and market price become another list of important factors to consider in making a final decision. Several respondents suggested that one of the disadvantages of SRWC is a lack of annual income when compared to conventional agriculture. In order to compensate for lack of income during the growing season, SRWC should be planted either in phases (to spread out the harvesting over multiple years) or farmers should consider diversification of their farms and combine SRWC with other agricultural crops that would give them yearly income.

Concerns over the lack of profitability have been among the major factors causing doubts in the respondents on whether to adopt or to reject the practice. Until 2012, only two of the respondents have had any harvests and some economic and market experience. Both of the experiences, however, are very different. One of the experiences with willow wood chips, suggest an average cost of 9 EUR/m^3 for wood chips. According to the respondent, 1 ha of willow yielded approx. 200 m^3/yr resulting in 600–700 EUR per ha per year (considering that SRWC are harvested once every 3 years). When compared to the conventional agrocrops, the respondent believed, that the results are encouraging. Another experience with the production of willow fences for Danish and Latvian markets, suggests disparities between the consumer attitudes and cost of the final product. The cost of willow fence (size of 150 × 180 meters) in Danish market is 27 EUR but in Latvia only 18–21 EUR. According to the respondent the average income has been 165 EUR/ha (after the first three years). While Danish customers have been at ease with the added delivery cost, local customers, however, have been reluctant to pay for the delivery. Increasing cost of delivery, due to the rising fuel prices over the last few years have made the sales in the local market even more difficult.

Lack of well-established and reliable wholesale market to purchase willow planting material for the purposes of setting a large scale willow plantations has also been identified as one of the drawbacks to proceed with SRWC. While the majority of the respondents had used various nurseries to acquire planting material for their trials, they suggested that if they would decide on adopting the SRWC practice, they were not sure about the potential sources of plant material, including reliability and price of the planting material.

Implementation and Confirmation Stage. Out of all of the respondents, only three have adopted the willow practice to the extent where they had at least one or two harvests. However, all of the respondents suggested, they would prefer to wait another 3 to 4 years before they decide to confirm and continue the practice.

Communication channels throughout the decision making process. The majority of the respondents communicated with the local or foreign experts, but had never consulted with other willow growers in Latvia. Only one respondent suggested that he would contact other willow growers in Latvia before the planting season, but would not keep up with more frequent contact. Several respondents suggested that they considered everyone to some extent a beginner. The respondents did not feel that contacting other willow growers in Latvia would be helpful to better understand and adopt the practice. When looking for practical solutions they would rather consult with foreign experts or with the local experts at the LSFRI "Silava" or at the nurseries. The majority of the respondents, however, seemed to be indifferent towards a proposal of developing a communication platform, such as an association of willow growers, and believed that greater cooperation among willow growers will depend on policy incentives to support the production of SRWC in Latvia.

Discussion and conclusions

During this study, we learned that the majority of the willow growers are still at the early phase of adoption of SRWC practices and could be classified as innovators or early adopters. The study also showed that while the level of awareness among the respondents on SRWC practices and its relative advantage was fairly good, there was lack of practical experience and knowledge specific to the conditions of SRWC management in Latvia. Several respondents were facing dilemmas (e.g. land availability, production costs, profitability, inadequate state support and ineffective treatments) that made them less confident to adopt the SRWC practice. The study further revealed a lack of communication between the willow growers in Latvia that should be addressed. This study also helped to identify and draw some conclusions on the key factors that help or hinder to adopt SRWC practice in Latvia, such as:

(1) *Payments for SWRC in Latvia and other EU countries*. To address the concerns expressed by several respondents on the difference between the subsidy payments (i.e. SAP) for SRWC in Latvia and other EU countries, Latvia indeed ranks as one of the lowest in SAP among other EU member states (EC). In 2009 willow growers in Latvia could receive an annual subsidy of 59 EUR/ha in SAP for management of SRWC; in 2010, 2011 and 2012 the amount was 65 EUR/ha, 76 EUR/ha and 85.11 EUR/ha, respectively (RSS**)**. SAP payment, however is available only for management of SRWC and is not available for the establishment of the plantations. The up-from costs for the establishment of SRWC, therefore, has to be covered by farmers themselves. In addition to SAP, farmers can also receive Least Favourable Areas Payments (LFAP). LFAP is an annual payment for agricultural areas with unfavorable conditions for agricultural production, such as marginal areas with remote access, poor soil quality and/or poor socio-economic performance. In 2012 LFAP ranged from 25–58 EUR/ha.

In comparison to other EU countries where willow growing has been successful, for instance UK and Sweden, farmers in UK, could receive 241.14 Euros/ha from the Single Payment Scheme (SPS) in 2010 and 289.94 Euros/ha in 2011 (DEFRA). Whereas, the first subsidies for willow planting in Sweden, during 1991 and 1996, were as high as 1,200 ECU/ha and 480 ECU/ha for fencing (Rosenqvist 2000). In later years, willow growers in Sweden could receive approximately 515 Euro/ha (LSFRI Silava 2005). Harvesting cost of SRWC in Sweden is approx. 400 Euro/ha or 9.8 Euro per 1 oven dry ton (odt^{-1}) of wood (LSFRI Silava, 2005). The average cost of the establishment of willow plantation in Latvia is approximately 1,150 Euro/ha, of which 430–572 Euro/ha is the site establishment (LSFRI Silava 2005). This suggests that SAP in Latvia does not adequately reflect the actual cost of the establishment and maintenance of SRWC, causing financial obstacles for adoption of SRWC practice in Latvia.

(2) *Land availability*. While the respondents expressed their concerns over the agricultural land availability for SRWC, according to the recent estimates 261,710 ha of abandoned agricultural land are suitable for the establishment of SRWC and could potentially become available for SRWC production (Abolina 2013). In only 5 % of this estimate (i.e. 13,085 ha) would be used for SRWC, at the rate of 7–10 (odt) ha-1 yr-1, it could supply 485,475–693,535 MWh of biomass energy annually (Abolina 2013). The largest proportion (29 %) of abandoned agricultural land suitable for SRWC are located in Latgale region (75,530 ha) (Abolina 2013).

(3) *Market and infrastructure.* There are several aspects of infrastructural improvements designed for utilization of SRWC. Latvia has recently been investing in new co-generating plants. As of the 2011, there were 83 co-generation plants with the total output of 3,133.7 GWh of electro energy and 4,147.6 GWh of heat energy (MoE). The first and the largest co-generation plant utilizing wood products, such as wood chips, wood pellets and sawdust was opened in October 2010 in Jēkabpils with the total power of 6.7 MW and 1.4 MW of heat power, which is enough to supply electricity to 4,000 households and 2,000 with heat energy at 5.3 MW heat rate (Kalnina 2011). Several other new co-generation plants along with the wood chip storage has already been opened and are planned across Latvia (Misina 2012, Petersone 2012, VM 2012, Delfi Bizness 2012, Levalde 2012, Knusle-Jankevica 2009, Paeglkalne 2013). These developments and the growing market demand for renewable energy, suggest great potential for biomass utilization for the coming years, serving as infrastructural and economic considerations in helping to adopt the SRWC practice in Latvia.

The proposed are the following areas for improvements that could foster the rate of adoption of SRWC practice in Latvia: (1) to provide greater state support and policy incentives towards SRWC, especially for the early stages of establishing the plantations; (2) to increase information availability and knowledge on treatments and practices for SRWC production in Latvia with practical information and demonstrations; (3) to create market incentives for SRWC products; (4) to continue developing necessary infrastructure for the utilization of SRWC products; and (5) to develop and maintain an effective platform of communication for the willow growers in Latvia.

Strengths and limitations of the study

One of the limitations affecting this study is a relatively small sample size which set a certain limitation to perform statistical analysis of the results. However, the Diffusion of innovations framework served as a useful tool to structure the answers and to better understand the process of adoption of SRWC practices in Latvia. While one could argue the effects of a small sample size on statistical importance of the results, it is also important to bear in mind that innovators and early adopters comprise a relatively small fraction of the population (Rogers 1995). Therefore, we considered their experiences crucial to understand the process of adoption of SRWC practices in Latvia and potential ways for improvement. Qualitative approach of data gathering, such as in depth interviews, gave certain advantages over conventional methods (e.g. structured surveys) and allowed us to gain a greater understanding of each willow grower personal experi-

ence with SRWC, their social and economic conditions, personal characteristics, and enriched our understanding on the importance, values and expectations each of the respondents placed towards the adoption of innovation. The ability to tell their own story gave us a better glimpse on how each individual perceived the innovation and the important factors that determined their interest towards adoption of the practice. We strongly believe that despite the relatively small number of participants involved in this study we were able to capture the depth and breadth of the knowledge valuable for the analysis of the adoption of SRWC in Latvia.

Acknowledgements

This research has been carried out with the support of State University of New York College of Environmental Science and Forestry (SUNY-ESF), Latvia State Forest Research Institute (LSFRI) "Silava" and the European Regional Development Fund (ERDF) project "Elaboration of models for establishment and management of multifunctional plantations of short rotation energy crops and deciduous trees" Nr. 2010/0268/2DP/2.1.1.1.0/10/APIA/VIAA/118. We would also like express our gratitude to the Fulbright fellowship program, the Institute of International Education (IIE), the Randolph G. Pack Environmental Institute at SUNY-ESF and LSFRI "Silava" for their support and collaboration. The authors express special thanks to all the farmers who agreed to be interviewed and participated in this study.

References

Abolina, E. 2013. "Social-Ecological analysis for Establishing Sustainable Multifunctional Forestry Systems in Latvia". Dissertation. State University of New York College of Environmental Science and Forestry, Syracuse, New York, USA.

Aikens, M.T., Havens, A.E. and Wilson, A.F. 1974. The Adoption of Innovations: The Neglected Role of Institutional Constrains. The Ohio State University, Department of Rural Sociology, Columbus, Ohio.

Börjesson, P.I.I. 1996. Energy analysis of biomass production and transportation. *Biomass and Bioenergy* 11(4): 305–18.

[CM] Cabinet of Ministers Regulation No.139. March 13, 2013. "On the procedures to receive the support for agriculture from the state and European Union within the direct payment scheme" [Ministru kabineta noteikumi Nr.139 "Kārtība, kādā tiek piešķirts valsts un Eiropas Savienības atbalsts lauksaimniecībai tiešā atbalsta shēmu ietvaros" 2013.gada 12 marts].

[EC] European Commission Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. *Official Journal of the European Union* L140:16–62.

Eisentraut, A. 2010. Sustainable Production of Second-Generation Biofuels: Potential and Perspectives in major economies and developing countries. Information Paper. International Energy Agency.

Ericsson, K., Rosenqvist, H., Ganko, E., Pisarek, M. and Nilsson, L. 2006. An agro-economic analysis of willow cultivation in Poland. *Biomass and Bioenergy* 30(1): 16-27.

[ESRI] Environmental systems Research institute, Inc. Available at: <http://www.esri.com/> [Cited March 1, 2013].

[EU] European Union. Summaries of EU legislation. Single Farm Payment. Official Website. Available at: <http://europa.eu/legislation_summaries/other/l111089_en.htm> [Cited March 28, 2013].

[DEFRA] United kingdom Department for Environment, Food and Rural Affairs. Rural Payments Agency. Available at: <http://rpa.defra.gov.uk/rpa/index.nsf/home> [Cited March 28, 2013].

Delfi Bizness. 2012. News Portal. "New bio-cogeneration plant emerges in Liepaja" [lv. "Liepājā sāks būvēt jauno biokoģenerācijas staciju"] Available at: <http://www.delfi.lv/bizness/uznemumi/liepaja-saks-buvet-jauno-biokogeneracijas-staciju.d?id=42175842> [Cited March 28, 2013]

Fritsche, U.R., Sims, R.E.H. and Monti, A. 2010. Direct and indirect land-use competition issues for energy crops and their sustainable production – an overview. *Biofuels, Bioproducts and Biorefining* 4: 692-704.

Kalnina, I. 2010. Brīvā Daugava. News portal. "Opening of Biomass cogeneration facility in Jekabpils" [„Jēkabpilī atklāta biomasas koģenerācijas elektrostacija"] Available at: <http://www.bdaugava.lv/?kat=1&news_id=10498> [Cited March 28, 2013]

Knusle-Jankevica, I. 2009. Jelgavas vēstnesis. News Portal. "Plans on building co-generation plant in Jelgava" ["Jelgavā grib būvēt biomasas koģenerācijas staciju"] Available at: <http://www.jelgavasvestnesis.lv/page/54&news_id=4881> [Cited March 28, 2013]

Lazdina, D., Lazdins, A. and Karins, Z. 2007. Short rotation plantations of fast-growing tree species as source of bioenergy in Europe and Latvia. In: Engineering for Rural Development. Proceedings of the International Scientific Conference 6: 90-95. ISSN 1691-3043.

Levalde, V. 2012. Dienas Bizness. News Portal. "Company UPTK plans to build a wood chip storage in Liepaja" [„Šķeldas noliktavu Liepājas enerģijas koģenerācijas stacijai būvēs firma UPTK"] Available at: <http://www.db.lv/ipasums/buve/skeldas-noliktavu-liepajas-energijas-kogeneracijas-stacijai-buves-firma-uptk-385070> [Cited March 28, 2013]

Lockheed, M.E., Jamison, D.T. and Lau, L.J. 1980. Farmer education and Farm Efficiency: A survey. The University of Chicago. 0013-0079/81/2901-0003

[LSFRI Silava] Latvian State Forest Research Institute "Silava" Available at: <http://www.silava.lv> [Cited March 1, 2013]

[LSFRI Silava] Latvian State Forest Research Institute "Silava". 2005. A handbook on the establishment and management of willow plantations. [Kārklu plantācijas ierīkošanas un apsaimniekošanas rokas grāmata]. LSFRI Silava.

Misina, I. 2012. LA.lv. News Portal. "Estonian's open cogeneration plant in Valka" [lv. „Igauņi Valkā atklāj koģenerācijas staciju]. Available at: <http://la.lv/index.php?option=com_content&view=article&id=362712:igaui-valk-atklj-koenercijas-staciju&Itemid=105> [Cited March 28, 2013]

[MoE] Ministry of Economics of the Republic of Latvia. Available at: <http://www.em.gov.lv/> [Cited March 8, 2013].
[MoE] Ministry of Economics of the Republic of Latvia. Informative Report on "The proposed
Action for Republic of Latvia on Renewable Energy to implement the Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC by 2020. Riga, 2012.
Öhlmér, B., Olson, K. and Brehmer, B. 1998. Understanding farmers' decision making processes and improving managerial assistance. *Agricultural Economics* 18(3): 273-90.
Paeglkalne, S. 2013. Jēkabpils Laiks. News Portal. "Plans on building co-generation plant in Krustpils" ["Krustpils pagastā plāno būvēt koģenerācijas staciju"] Available at: http://www.jekabpilslaiks.lv/index.php?mod=1&op=out&id=16506&r=Jekabpils> [Cited March 28, 2013].
Pētersone, S. 2012. Ziemeļlatvija. News Portal. "Energy in municipalities will be produced from co-generation plants" ["Enerģiju novados ražos koģenerācijas stacijas"] Available at: <http://www.ziemellatvija.lv/biznesa-zinas/darba-birza/energiju-novados-razos-kogeneracijas-stacijas-1191> [Cited March 28, 2013]
Rogers, E.M. 1995. Diffusion of innovations. New York: Free Press.
Rogers, E.M. 1962. Diffusion of innovations. Glencoe: Free Press. ISBN 0612628434.
Rogers, E.M., Singhal, A. and Quinlan, M.M. 2009. Diffusion of innovations. A chapter in Stacks D. and Salwen M. ed. An integrated approach to communication theory and research. 2nd edition. New York: Routledge, p.26.
Rosenqvist, H., Roos, A., Ling, E. and Hektor, B. 2000. Willow Growers in Sweden. *Biomass and Bioenergy* 18(2): 137–145.
[RSS] The Rural Support Service of Latvia. (lv. Lauku Atbalsta Dienests) Available at: <http://www.lad.gov.lv/> [Cited March 1, 2013]
Ruttan, V.W. 1996. What happened to technology adoption-diffusion research? *Sociol Ruralis* 36(1): 51-73.
Saldana, J. 2009. The coding manual for qualitative researchers. Los Angeles, CA: SAGE.
[VM] Valmiera Municipality. 2012. Valmiera24.lv News portal. "The new co-generation plant allows for reductions in cost of the heating" [„Jaunā koģenerācijas stacija ļāvusi samazināt siltuma tarifu"] Available at: <http://www.valmiera24.lv/zinas/48/159596> [Cited March 28, 2013]
Volk, T.A., Verwijst, T., Tharakan, P.J., Abrahamson, L.P. and White, E.H. 2004. Growing fuel: Sustainability assessment of willow biomass crops. *Frontiers of Ecology and Environment* 2(8): 411-418.

Received 10 May 2013
Accepted 15 May 2014

АНАЛИЗ ВОЗНИКНОВЕНИЯ И РАЗВИТИЯ ПРАКТИКИ ВЫРАЩИВАНИЯ ИВЫ В ЛАТВИИ

Е. Аболиня, В. А. Лузадис и Д. Лаздиня

Резюме

Выращивание ивы впервые было представлено латвийским фермерам и лесоводам в середине 1990-х годов в качестве альтернативного источника биоэнергетики в дополнение к традиционной практике сельского и лесного хозяйства. Выращивание ивы, однако, все еще является довольно необычной практикой в Латвии. Общая площадь, используемая для посадки ивы в 2012 году, составила всего 261 га. Для изучения характеристик и процесса принятия решений фермерами, выращивающими иву в Латвии, была применена теория диффузии инноваций. Интервии и полевые наблюдения позволили изучить опыт садоводов, выращивающих иву, их источники коммуникации и методы освоения практики выращивания ивы. Результаты показали, что садоводов, выращивающих иву в Латвии, можно охарактеризовать как «новаторов» или «ранних последователей». Все респонденты рассматривают иву как прекрасную возможность использования сельскохозяйственных земель, особенно в районах, неподходящих для производства продуктов питания. Результаты показали, что в то время, как некоторые садоводы были готовы начать выращивать иву, они столкнулись с некоторыми препятствиями и неопределенностью, которые затруднили процесс принятия решения. Все респонденты сошлись на мнении, что они предпочли бы подождать три-четыре года, прежде чем принять решение об освоении или продолжении практики выращивания ивы. Результаты также показали отсутствие установленных сетей коммуникации между садоводами, выращивающими иву в Латвии. Исследование предлагает несколько областей для улучшения практики с целью повышения скорости процесса принятия решений по выращиванию древесных культур с коротким периодом ротации.

Ключевые слова: древесные культуры с коротким периодом ротации; ива; садоводы; освоение инноваций; качественные исследования